PROCEEDINGS

OF THE

American Forestry Association

AT THE

Summer Meeting, held in Quebec, September 2—5, 1890,

AND AT THE

Ninth Annual Meeting, held in Washington, December 30, 1890.

WASHINGTON, D. C.
Secretary's Office, 1429 New York Ave.
1891.

NOTE.—*The American Forestry Association, whether inviting persons to read papers from its platform, or publishing those papers afterwards in connection with its proceedings, is not to be understood as endorsing the views expressed, or adopting them as its own. It offers its platform for the purpose of promoting a free and full discussion of all questions of importance connected with the subject of Forestry.*

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CONSTITUTION

OF THE

AMERICAN FORESTRY ASSOCIATION.

ARTICLE 1. This Association shall be known as the American Forestry Association.

ARTICLE 2. The objects of this Association shall be the discussion of subjects relating to tree-planting, the conservation, management, and renewal of forests, and the climatic and other influences that affect their welfare; the collection of forest statistics; and the advancement of educational, legislative, or other measures tending to the promotion of these objects. It shall especially endeavor to centralize the work done and diffuse the knowledge gained.

ARTICLE 3. Any person may become a member of this Association, subject to approval by the Executive Committee, by the payment of the annual dues. The annual dues shall be two dollars. Any member may become, by the payment of fifty dollars at one time, a life member, and shall not be liable thereafter to annual dues. Any person contributing one hundred dollars to the Permanent Fund of the Association shall be a Patron.

ARTICLE 4. The officers of this Association, to be elected at the annual meeting, shall be a president, one vice-president for each State, Territory, and Province represented in the Association, a treasurer, a recording secretary, a corresponding secretary, and an executive committee consisting of these officers and six other members. Three of this committee shall constitute a quorum. This committee shall choose its own chairman.

ARTICLE 5. The President shall preside at all meetings of the Association in General Session, and in his absence a Vice-President shall preside.

ARTICLE 6. The Recording Secretary shall keep a record of the proceedings of the Association, and shall be custodian of all documents, books, and collections ordered to be preserved.

ARTICLE 7. The Corresponding Secretary shall conduct the correspondence of the Association.

ARTICLE 8. The Treasurer shall have charge of all funds, and pay out the same on the direction of the Executive Committee.

ARTICLE 9. The Association at any regular meeting, or its Executive Com-

mittee in the intervals between its meetings, may appoint such local or special committees as may be deemed proper, and shall define their duties.

ARTICLE 10. The annual meeting of the Association shall be in the months of August, September or October, or at such times and places as shall be determined by a vote in General Session or by the Executive Committee. Special meetings may be called by the Executive Committee.

ARTICLE 11. At each annual meeting there shall be an election of officers for the ensuing year, and they shall remain in office until others are chosen. In cases of vacancies occurring in the intervals between the annual meetings, they may be filled by the Executive Committee until others are selected. In case of absence of an officer at a regular meeting his place may be deemed vacant.

ARTICLE 12. The officers of States, Territories, Provinces, or Local Forestry Associations, or their delegates, or the delegates of any Government, may participate in the proceedings of the Association as Honorary Members.

ARTICLE 13. This Constitution may be amended by a two-thirds vote of the members present at any annual meeting.

BY-LAWS.

1. Papers or abstracts of papers to be read must be sent two weeks before any meeting, for classification, to the Corresponding Secretary.

2. The following classification of subjects is adopted for the reading of papers :

Section A. Forest Planting, Forest Management, Forestry Proper, Preservation of Forests.

Section B. Forest Economy, Technology and Statistics.

Section C. Applied Science and Climatology, General Topics.

3. Contributors who are present shall have the preference in reading their papers.

4. Any member shall be entitled to the privilege of using any books or documents, not of record, at the discretion of the Recording Secretary.

Summer Meeting,

Held in Quebec, Sept. 2d to 5th, 1890.

TUESDAY, SEPTEMBER 2d.

The Association met in the Hall of the Legislative Council at 8 P. M., many ladies and gentlemen of Quebec being present. Hon H. G. Joly, of Quebec, First Vice-President, called the meeting to order and read a letter from Gov. James A. Beaver, of Pennsylvania, the President, regretting his unavoidable absence and expressing his earnest wishes for the success of the meeting. The Lieutenant Governor of Quebec, Mr. Angers, then welcomed the Association on the part of the Provincial Government, referring to the importance of the lumber interests of Canada, the necessity of proper forest administration, and the system now pursued in Quebec and the other provinces, which may be summed as follows:

In Canada licenses are issued for cutting timber on the Government land. A very large proportion of all the timber land of the country is still in the hands of the Government, hence the Government can control the cutting of the timber, and has adopted certain rules with regard to the cut, which it is the duty of the Government Inspectors to see enforced. Thus, pines less than twelve inches and spruce trees less than nine inches at the butt must by law remain free from the axe. By this system the young trees are spared, and at the end of twenty or thirty years a new crop of commercially valuable timber is ready to be cut.

One can get some idea of the importance of the timber product of Canada from the statement that between 1867 and 1889 430,000,000 feet of lumber, board measure, and 69,600,000 cubic feet of timber, had been cut in the Province of Quebec alone. The Crown timber dues amounted to $9,800,000, and last year, from that source alone, the Province received nearly a million dollars.

This drain upon the forests, he said, could only be borne if they were wisely and economically managed, and the American Forestry Association was looked to for advice and suggestions in regard to such management.

Mr. J. M. Le Moine, President of the Reception Committee,

followed with an address of welcome on behalf of the citizens. These addresses were responded to by Mr. Bernhard E. Fernow, Chief of the Forestry Division of the United States Department of Agriculture. He spoke of the example of forest preservation set by the early American settlers, especially those of Canada, an example which their descendants had ceased to follow, of the rise, growth, and work of the Association, and of the help and encouragement received from its Canadian members.

Brief addresses were made of Dr. Peter H. Bryce, of Toronto, Mr. William Little of Montreal, and Mr. Joly, after which the meeting adjourned.

Wednesday, September 3d.

Morning Session, 10 A. M., Mr. Joly in the Chair.

A resolution to defer the election of officers to a winter meeting, to be held in Washington, D. C., was adopted.

The members and delegates in attendance were reported as follows:

Colorado. Col. E. T. Ensign, Forest Commissioner.

Florida. Mrs. W. J. Keyser, Milton.

Maine. Hon. George F. Talbot, Portland.

Massachusetts. J. D. W. French, Boston; N. T. Kidder, Milton; John M. Woods, Somerville.

New Hampshire. J. B. Harrison, of the Forest Commission.

New York. Gen. James Grant Wilson, New York.

Ohio. Prof. W. R. Lazenby, Agric. Experiment Sta., Columbus.

Pennsylvania. Mrs. Brinton Coxe, Philadelphia; Thos. J. Edge, Secy. State Board of Agriculture; Dr. Henry M. Fisher, Philadelphia; Mrs. George F. Heston, Newtown.

District of Columbia. B. E. Fernow, Chief of Forestry Division; Mrs. Fernow.

Ontario. Hon. Archibald Blue, Dr. Peter H. Bryce, Toronto; John Craig, Ottawa; Hon. A. White, Toronto; Aubrey White, Deputy Commissioner of Crown Lands.

Quebec. Edward A. Barnard, Secy. Board of Agriculture, Ulric Barthe, Quebec; Hon. Louis Beaubien, Montreal; Archibald Campbell, Quebec; W. P. Greenough, Pontneuf; Hon. H. G. Joly de Lotbinière, Pointe Platon; J. M. Le Moine, Quebec; William Little, George Moore, Montreal; H. O. Moore, Moore's Station; J. X. Perrault, Montreal; H. M. Price, Hon. L. A.

Robitaille, Hon. D. A. Ross, Hon. E. E. Taché, Deputy Commissioner of Crown Lands, Richard Turner, Prest. of Chamber of Commerce, Quebec.

Reports of the conditions of forestry interests in the several States and provinces were then made as follows:

Col. E. T. Ensign made a report for Colorado.

Hon. George F. Talbot, of Maine, spoke of the wasteful method of utilizing forest products that he had observed in his own State. Immense numbers of young pine and spruce trees which, if left to themselves, would in the course of a few years furnish valuable lumber, were habitually sacrificed for wood pulp, scantling, matches, etc., while remnants from the saw-mill would answer the same purpose. "We, in the State of Maine," he said, "are obliged to go in search of our masts to the State of Washington; to Tennessee or Michigan for boards of a quality good enough for the fine inside work of our hotels and private houses. Our water courses, since the destruction of our forests, have become capricious torrents, inundating the whole surrounding country after each heavy rain, while the beds of these streams dry up a few hours later."

Mr. Talbot alluded to the scheme which had been proposed: that townships should secure the title to tracts of waste lands, these lands to be protected, as far as possible, from fire and pasturage, and administered by the town for the benefit of the tax-payers in such town or township. This scheme he thought was particularly applicable to Maine, where the assessments on timber land were too high and the risks too great for owners not provided with large capital to keep land in timber.

Mr. John M. Woods presented a brief statement of the condition of the forests and woodlands of Massachusetts.

General James Grant Wilson, of New York, spoke of the terrible devastation in the Adirondack forests, and of the efforts that were now being made to secure State control of those forests. He alluded to the beneficial results of Arbor Day, and the private attempts at reforesting waste districts, mentioning those of Hon. William Walter Phelps, who had for some years been engaged in this work, planting on an average 40,000 trees each year.

Prof. W. R. Lazenby reported the condition of affairs in Ohio.

Mr. Aubrey White, Deputy Commissioner of Crown Lands for the Province of Ontario, gave a very interesting account of the present forest administration of that Province. The Government of Ontario, like that of Quebec, leases the right to cut timber on

certain limits, but restrictions are also imposed in Ontario as to the size of the timber to be cut. Mr. White gave figures from the Crown Lands' office, showing how large had been the increase of late years of the license fees for timber limits.

He also presented some very interesting details on the Ontario system of forest protection against fire by the joint action of the holders of limits and the Government, each contributing an equal share of the expense.

The reports of the Executive and Legislation Committees were then read by the Acting Secretary, Dr. H. M. Fisher.

REPORT OF THE EXECUTIVE COMMITTEE.

To the Members of the American Forestry Association:

The Executive Committee presents the following report on the condition of the Association, the work done since the last annual meeting, and the condition and prospects of the movement for forest reform.

At the annual meeting in October last an important change was made in the composition of this committee, in order, as it was hoped, not only to render it more effective for continuous work by securing a quorum of members within reach of each other, but also to keep it in touch with the forestry movement all over the country by officially connecting with the committee one member, a vice-president, in every state, territory and province. In fulfilment of this latter feature of the plan, your committee, as instructed, has elected vice-presidents in twenty-five states, one territory, the District of Columbia, and the Province of Ontario, Quebec being already represented. . Vice-presidents for the four other states where we have members will be chosen as soon as proper selection can be made. The plan was a good one, save in one most important particular, and this defect has seriously crippled the work of your committee. No five members (the number fixed as a quorum) reside near enough to each other to hold any meetings without decided inconvenience, and hence all conference has had to be by correspondence, and the treasurer and corresponding secretary have had to act on their own responsibility much more than they had any desire to do. If hereafter the committee be composed chiefly of members resident in one place, who can meet regularly, they will not only accomplish far more work, but also stimulate the

activity of the vice-presidents, and avail themselves of the help rendered by the latter. The wisdom of having these vice-presidents is already seen in the accession of new members, many of whom have been brought in through their influence.

Owing to the need of the change above suggested, it was thought best to defer the incorporation decided upon at the last meeting.

Though thus defectively organized, the committee has not been inactive. The treasurer's report last year showed the immediate need of a larger income. To secure this, and also to diffuse and increase the association's influence, an increase in the membership was indispensable. As this question of membership is of great importance to the continued life of the association, a few facts and figures in regard to it are worth considering. Originally planned as a congress of delegates from local forestry associations, this body only sought to secure members enough in each state to form the nucleus of that local society which they were expected to found, and no special effort was made to gain a large membership for the parent association. Very few local societies were formed however, and none in any way tributary to the parent body, so it became clear that our own members could alone give us strength and influence, that we must either increase or decrease, and that our members having decreased very considerably since a few years ago, the tide must be turned or we should soon cease to exist at all. Accordingly, with the copies of Mr. Schurz's address sent in pamphlet form to all members in November last, a circular was also sent stating the needs of increased membership, and asking each member to appeal to his own friends and acquaintances to join the association, experience having shown that this could be made the most effective means of winning new members. While a few, especially in Massachusetts and New York, exerted themselves to fill our ranks, the idea of each man working for the association by constituting himself a recruiting sergeant seems to have been too novel, and the call met with no general response. An appeal for members and contributions, explaining the objects of the Association, was also printed and widely distributed, partly by individual members, but chiefly from the secretary's office.

In response to the appeal and the personal solicitation of members, over sixty new members have been added since the October meeting, exclusive of several who joined during that meeting. This brings our present total to 196, which would have been greater but that twenty-three names have been struck off the rolls

on account of death, resignation, and continuous non-payment of dues. The number of new members may seem small, but as hitherto there have been practically no accessions except at the annual meetings, it is a clear gain. It is interesting to note that among the number are some old members who had resigned, but who now desire to join the ranks again.

At the beginning of the year there were seventy members, nearly half the total membership at that time, who had been admitted to life membership some years before on payment of ten dollars. Necessary current expenses had in the course of time exhausted the sum so raised, so that the whole expense of the association was being borne by the eighty-five other annual members, although many of them had paid in dues more than the life membership fee. A statement of the facts, suggesting a voluntary relinquishment of their rights, was sent to all life members, and it is gratifying to state that while no disapproval of the scheme has been received from any one, fifteen of the members have resumed payment of annual dues, while three others have become life members on payment of fifty dollars as provided in the amendment adopted last year. Of these new life members there are now eleven in all, and the fund of $550 secured thereby remains intact to form the nucleus of a permanent invested fund.

Our members are now found in twenty-nine states, one territory, the federal district, and two provinces of Canada, as follows:

Alabama, 2; Arizona Ty., 1; California, 6; Colorado, 5; Connecticut, 4; Florida, 2; Georgia, 7; Illinois, 4; Indiana, 2; Iowa, 1; Kansas, 2; Kentucky, 3; Maine, 5; Maryland, 1; Massachusetts, 40; Michigan, 1; Minnesota, 5; Missouri, 2; Nebraska, 4; New Hampshire, 2; New Jersey, 4; New York, 27; Ohio, 14; Pennsylvania, 22; Rhode Island, 2; South Carolina, 4; Tennessee, 2; Texas, 1; Vermont, 2; Wisconsin, 1; District of Columbia, 7; Ontario, 6; Quebec, 6; In short, while our membership is small, it is believed that there are few if any nominal members, and if only each individual member will bring in a few others, *women as well as men*, our growth may be very rapid.

The experience of other associations clearly proves that in a body that meets as rarely as ours, it is absolutely necessary to keep up the interest of the members by the distribution of publications, and at the Atlanta meeting in 1888, it was decided to subscribe to the Pennsylvania Forestry Association's paper, "Forest Leaves," for all our members, so that it could be sent to them regularly. Your

committee have continued this subscription (which is made at a very favorable rate) and believe it the best policy to do so, as the paper not only brings before all our members very valuable and interesting information in regard to forestry, but also helps to keep them in touch with the forestry movement all over the country. Besides this it supplies a ready means of reaching an appreciative class of readers for all matter which this Association or its members may wish to have published.

In view of this arrangement it was thought better not to print a pamphlet report of the last meeting (as had sometimes formerly been done) but to have the minutes published by themselves in Forest Leaves, and also, in successive numbers, the papers read or presented at that meeting. A great saving of expense has been effected thereby, and the proceedings of the meeting have been much more widely made known than could readily have been done otherwise.

The report of the Committee on Legislation will show what has been done in the effort to secure a proper legal basis for national forest preservation, but in addition thereto the general status of the forestry movement all over the country needs a few words.

It is true, that there is as yet little that is new to be said as to the actual treatment and condition of the forests themselves. The old story of wasteful cutting, of the laying bare of mountain slopes where trees are absolutely essential to hold the soil together, and of the ravages of fire, a story with which this Association is but too familiar, must be told again this year. The terrible fires of 1889 will probably long remain without a parallel, but it is only a question of degree. Without adequate protection from fire, the loss must be serious enough every year. As to cutting, too, the absolute divorce, which has existed in this country ever since its settlement, between the mutually essential occupations of timber-cutting and timber-raising, continues practically unchanged.

On the other hand, signs of an approaching change and a fundamental improvement in the treatment of our forests are clearer now than ever. Your committee has been in correspondence with citizens and the press all over the country, and it is undeniable that a very general awakening to the necessity of forest preservation is taking place, gradually indeed, but surely. The increased numbers of this and other associations, the re-organization of the New York Association, the formation of that in Texas, and the successful meetings held in various places are proofs of this, nor are others

wanting. The press, formerly silent as to our forestry needs or unfavorable to any reform, is now throwing more and more of its influence in aid of the movement for forest preservation; and in this connection too much cannot be said of the energy and intelligence with which the condition of the Adirondacks has been laid before the public. The fact that the approaching scarcity of timber has led many owners of forest lands to hold them for higher prices should also not be disregarded. The temporary forest preservation thereby effected is both a good thing in itself and a necessary first step to proper forest management; and while the latter is probably not yet even in contemplation, its advantages must eventually appeal to men who have already learned to look beyond the present moment.

The loudest cries for forest reform come from the widely separated States of New York and California. The effects of deforestation in the Adirondacks touch the manifold interests of a large number of people so closely and so plainly that the mere reservation of some forest lands under the charge of an unpaid commission cannot satisfy the demand for the preservation of the Adirondack woods. The existence of this demand was made evident at the last session of the New York Legislature, and if the end in view is steadily pursued it can hardly fail of eventual attainment. The New York Forestry Association has its work clearly before it, and should receive aid and encouragement from every patriotic citizen of the State.

In California the prosperity of many fruitful valleys is dependent on a water supply of whose regularity the existence of forests on the mountains is the only guarantee. Axe and flame have made serious inroads on those forests, and they are also becoming more and more a pasture ground for sheep and cattle. The people are awake to the dangers which threaten them, but unfortunately their appeal for protection has to be made at Washington, and not at San Francisco, and amid the mass of legislation constantly before Congress it is no easy task to make the claims of one section heard. That a region which human industry has turned into a garden should relapse into a wilderness through the impossibility of securing proper legislation would be a sore reproach to our boasted American civilization.

In conclusion, your committee can frankly say that while present conditions are anything but satisfactory, and the prospect in many places far from hopeful, yet, through the agency of this and other

associations, the need of proper forest management is being gradually brought home to the minds of the American people. Upon the speed with which the people are won over to the cause of forest reform depends the nearness of the day when that great menace to our national welfare, the waste and destruction of our forests, shall be a thing of the past.

Respectfully submitted,
For the Executive Committee,
CHAS. C. BINNEY, *Secretary.*

REPORT OF THE COMMITTEE ON LEGISLATION.

To the Members of the American Forestry Association :—

Your Committee, elected by the Executive Committee chosen at the Philadelphia Meeting, respectfully report as follows :—

The members of this committee being widely scattered over the country, their conferences have been chiefly by correspondence. On November 14th, 1889, a meeting was held at the office of the Assistant Secretary of Agriculture, at Washington, D. C., to confer with a committee of the American Association for the Advancement of Science, and other persons interested in National forest preservation. Your committee was represented by Messrs. Ensign, Higley and Binney. There was a full discussion as to the actual condition of the National forests, the best practical means of preserving them, and the legislation that could reasonably be expected. The same day the above members of your committee, together with Assistant Secretary Willets, and Messrs. Fernow, Bowers and Egleston, of your Association, waited upon the Secretary of the Interior to express their views as to the reservation and protection of the public forest lands. Major Powell and Colonel Hinton of the United States Geological Survey were present.

In accordance with the understanding arrived at at these conferences, an admirable memorial was prepared by the American Association for the Advancement of Science, and transmitted by the President of the United States to Congress on January 20th ; and your committee prepared a Memorial to Congress and the House of Representatives Bill, No. 7026.—"For the reservation and protection of forest lands on the public domain, and to establish a commission to inquire into the condition of the said lands, and to report a plan for their permanent management." The Bill was intro-

duced in the House on February 17th, by Mr. Dunnell, of Minnesota, who afterwards secured the appointment by the Public Lands Committee (to whom the Bill had been referred) of a sub-committee on forestry legislation. The Chairman of this sub-committee being from Pennsylvania, the Committee on Law of the Pennsylvania Forestry Association coöperated by asking the influence of the latter Association and the press in support of the Bill. Mr. Fernow and others of your Association resident in Washington, and also Mr. Binney of this Committee, appeared before the sub-committee and found its members disposed to favor a measure more similar to your Association's Bill of two years ago. Messrs. Fernow and Bowers met the sub-committee and its members repeatedly during the session. Since, however, the Public Lands Committee has had much important work before it, and since a thorough revision of the land laws in all its parts is contemplated, including the present method of disposal of timber lands, action upon this particular legislation has been deferred until the more comprehensive plans of land legislation could be digested. But the assurance is given that, early in the next session, such a Bill for a permanent forest administration as will meet the views of the Committee on Puclic Lands, will be prepared by the sub-committee and laid before the House.

WILLIAM ALVORD, JOHN E. HOBBS, CHARLES C. BINNEY,
ABBOT KINNEY, HERBERT WELSH, J. STERLING MORTON,
EDGAR T. ENSIGN, WARREN HIGLEY, *Committee.*

After an active discussion of the various questions raised by the reports of the delegates and of the Committees, Mr. J. D. W. French moved that a Special Committee be appointed "to consider the Report of the Executive Committee, and the best means of obtaining some practical results from the work of this Association." This motion was carried, and the Chair appointed Messrs. French, Fernow, J. X. Perrault, J. B. Harrison, P. H. Vilmorin, E. E. Taché, Wm. Little, and Aubrey White as the Special Committee. The Congress then adjourned until 2 P. M.

Afternoon Session, 2 P. M.—Mr. Joly read a paper by Mrs. S. W. Dodds, M. D., of St. Louis, Mo., on "What Causes the Cyclones."

Mr. B. E. Fernow read a paper on "Forests as a National Resource;" While he was reading, the old Huron chief, Thomas Siouhi, entered the hall with his son, clad in full Indian costume.

When the paper was ended, the chief said, "We are the children of the forest, and are come to welcome the friends of the forest. Since I was sixteen years old, the forest has been my country. I have lived in it and I hope to die in it. We are not numerous; we are gradually disappearing like the great trees of our woods. Protect us and our forests, and you will have the prayers of the Hurons and the gratitude of their hearts."

Mr. Taché read an official report on "The Administration of the Public Forests of the Province of Quebec."

Mr. Joly exhibited at the close of the session a fine piece of black walnut grown from a tree planted by him at his place at Pointe Platon fifteen years ago. He said that in making such plantations of trees those of the highest commercial value should be selected.

Evening Session, 8 P. M.—Colonel E. T. Ensign, Forest Commissioner for Colorado, read a paper on "The Rocky Mountain Forests."

Dr. N. H. Egleston's paper on "The Preservation of Small Forests," was then read by title.

Professor Lazenby gave an interesting account of the method adopted in Ohio of celebrating Arbor Day, and said that Ohio was one of the first of the States to introduce into her public schools the annual observance of Arbor Day, and that the practice of tree planting on that day had perhaps been more generally and heartily carried out in Ohio than in any other State.

Mr. A. Blue stated that Arbor Day had been established by law in the Province of Ontario, and that the Government had appropriated $50,000 for Arbor Day and agricultural improvements.

After some remarks by Mr. Fernow and others as to the importance of endeavoring to secure an extension of the system of Arbor Day tree planting, Mr. H. L. de Vilmorin, of Paris, France, read by invitation a paper on the "Forest Administration in France."

Mr. Vilmorin is one of the partners in the seed house of Vilmorin & Andrieux of Paris, of world-wide reputation, and his description in brief of the system of forest management in France was listened to with deep interest.

Mr. Auguste Dupuis, of St. Roch des Aulnaies, read a paper on "Experiments with Southern Trees in the Far North of Quebec." Mr. Dupuis brought with him a number of samples of trees that he had planted.

Messrs Fernow, Talbot, Lazenby and Bryce spoke of the work upon which Mr. Dupuis had been engaged in terms of the warmest approbation.

Mr. Joly followed with a paper on "Tree Planting on the Prairies."

The meeting then adjourned till Thursday morning.

THURSDAY, SEPTEMBER 4th.

Morning Session, 10 A. M.—When the session opened His Excellency the Governor General, Lord Stanley of Preston, welcomed the American Forestry Association to Canada, and expressed his deep interest in the work of the Association.

Professor Lazenby, of the Ohio Agricultural Experiment Station, requested the members to excuse the absence of the paper he had promised on "Timber Planting in Ohio," which had unfortunately been stolen from him on his journey.

He, however, gave a brief resumé, from memory, of the main points in this paper, and stated which varieties of trees had been proved, by actual experiment at the Experiment Station in Ohio, to be most useful for plantations. Of these, the ash stood at the head of the list. He said that wagon builders in Columbus were complaining of the dearth of proper hard wood for wagons, particularly of hickory, and advised the planting of this and other trees, the demand for which was steadily increasing, while the supply steadily diminished..

Mr. J. X. Perrault, of Montreal, then read an abstract, in English, of a paper he had prepared on the "Adoption of a Regular System for the Cutting of Timber on Our Public Lands," "La Mise en Coupe réglée de nos Forêts."

Hon. G. Duhamel, Commissioner of Crown Lands for the Province of Quebec, then addressed the meeting on forestry.

Afternoon Session, 2 P. M.—At the opening of the afternoon session Sir Ambrose Shea, Governor of the Bahama Islands, visited the meeting. Mr. Joly having spoken of the pleasure it gave him to welcome so distinguished a guest to the Councils of the Association, Sir Ambrose thanked his friend, Mr. Joly, for the kind allusion to him, and speaking of recent events, expressed the hope that reciprocity between the United States and Canada would soon be established. Later in the afternoon the Congress received a visit from the Prime Minister of the Province of Quebec, the

Hon. Mr. Mercier, who was accompanied by Mr. Daniel Dougherty, of Philadelphia. Mr. Mercier and Mr. Dougherty both addressed the meeting. Mr. Dougherty spoke in favor of abolishing all trade barriers between the United States and Canada.

Mr. Fernow read a paper upon "The Effect of Forest Mismanagement on Orchards."

An address was then delivered by Mr. J. B. Harrison, of New Hampshire.

The Hon. J. K. Ward then read a paper on the "Duties of the Government and of Lumbermen in the Management of the Public Forests."

A discussion then ensued on Mr. Ward's scheme of fires and insurance.

Mr. William Little read a paper entitled: "The Protest of the Pine."

Mr. John Craig followed with a paper on "Forestry at the Dominion Experimental Farms."

Mr. William Saunders, Director of the Central Farm, in a paper on "Forestry on the Western Plains of Canada," further described the practical work done by the Dominion in the way of tree planting on the barren prairies.

Evening Session, 8 P. M.—Mr. Joly presented specimens taken from badly pruned trees, and spoke of the importance of pruning branches away close to the stem and making clean vertical cuts. He also distributed to the members of the Association some copies of Professor Sargent's edition of Count des Cars' work on "Tree Pruning." (These were the gift of the Massachusetts Society for the Promotion of Agriculture.)

The chairman then read a note from the Governor of Texas inviting the American Forestry Association to hold their next meeting in the State of Texas; referred to the Executive Committee. The report of the special committee which had been appointed "To consider the report of the Executive Committee, and the best means of securing some practical result from the work of the Association," was then read by the chairman of the special committee, Mr. J. X. Perrault.

The following is the *Report*:—

"His Honor the Lieutenant Governor of the Province of Quebec having suggested that this Association should propose such measures as they think advisable in order to secure the preservation and permanence of the forestry domains of the Province, the

American Forestry Association recommends: That the working of the timber limits should be so regulated that while the largest amount of timber may be cut which the virgin forest affords, this be not done without proper provision for a recuperation of the timber crop, or protection against fire, cattle, and other agencies injurious to the continuance of forest growth.

"The Association recognizes the fact that it is not in its power to devise the methods by which such recuperative reproduction may be attained, applicable to all the different conditions, political, administrative and forestal, which may prevail in the Province, but it would respectfully state some facts and principles which must be understood in order to inaugurate a forest policy superior to that now in existence.

"It would appear that without a special investigation of existing conditions, with a view of applying forestry principles in their management, such changes, with the present system, could not be attained.

"It is contrary to the public interest of any country, that lands which are covered with forest and have little or no agricultural value, should be opened for settlement or alienated by the State, but such lands should be kept in forest and carefully preserved from destruction by the ravage of fire, or by settlement. The methods by which the management and reservation may be effected are various and must be adapted to local conditions; but, whatever methods are employed, it is necessary to have an efficient and well-trained corps of officers conversant with the principles of forestry.

"The recuperation of a national forest is not effected by a simple utilization of the ripe timber and superior kinds of trees, and by leaving the remaining growth to itself. It can be economically and satisfactorily attained only by a wisely directed cutting which keeps in view the re-seeding of the original growth or of more valuable kinds.

"The protection of forests against fire and cattle is naturally of the first importance, and cannot be effected by legislation alone without devising the proper machinery to carry out the law. In regard to fire legislation, preventive measures are of more use than curative. Hence, all methods of cutting timber, such as the hewing of logs in the forest, by which inflammable material is accumulated in the forest, such should be discouraged.

"It must be recognized that the present methods of lumbering

take no consideration of the future of the resource upon which the lumber business is based, and any regulations that are adopted should promote such a change of methods as will secure continued forest growth upon the forest reserves. These regulations, along with legislation for the protection of the forest against fire and theft, will comprise perhaps all the forest administration that is at present practicable.

"It will be advisable to encourage young men to study forestry at one of the forestry schools of Europe, so that gradually a corps of forestry officers may grow up, capable of applying the more refined principles of forest management, when the time for such has arrived."

The report also submitted the following resolutions :—

I. *Regarding the State Board of Forestry of California.*

WHEREAS, The State of California has had, for some years past, a State Board of Forestry, charged with the forestry interests of that State in general, and with the protection of the timber lands of said State against fire and depredation, especially disseminating, at the same time useful information in their reports, and

WHEREAS, It has been suggested that political considerations may lead to a discontinuance of said board, or to such a reduction of the appropriations provided for such board, as must necessarily hamper its work and curtail its usefulness—

Resolved, that the Council and members of the American Forestry Association, in meeting assembled at Quebec, view with alarm the possible occurrence of such a contingency, rooting out, as it were, the first germ of a rational forest policy, which the State of California had wisely planted, and cannot without detriment to its agricultural interests afford to discontinue.

While, then, there is no personal connection between the members of the Forestry Board and the members of this Association, which is concerned in this matter only from its general interest in proper forest preservation, and while this Association does not desire to pass judgment in regard to the efficiency or inefficiency of the work of said Board, we earnestly hope and pray that any discontinuance or limitation in the functions of such Board, if contemplated, will find the vigorous opposition of every fair-minded legislator, and that efforts for an extension and increase of efficiency in this first and foremost American forest administration will alone meet with success.

Resolved, that a copy of these expressions of interest in the for-

est policy of the State of California, be forwarded to the Governor and Legislature of the State of California.

II. *Regarding the Big Trees of Tulare County, California.*

Resolved, that the American Forestry Association, being advised that the last grove of big trees in Tulare county is in danger, under the regular working of the land laws, of being turned over to private parties, respectfully submit to the Honorable Secretary of the Interior, that the value of these Sequoias, for their grandeur and their beauty, is much greater than it can be for lumber, and that their preservation as a monument of natural history is of national concern.

Resolved, that the American Forestry Association therefore urge the Honorable Secretary to use such power as is at his command to withhold from entry such grove or groves as are still in the possession of the general government, until proper legislation for the permanent reservation of the same can be enacted by Congress.

III. *Regarding Model Farms.*

Resolved, that in the attempts made to encourage agriculture by offering prizes for model farms, the importance of the woodlands necessary on every farm (deserving to be considered a model farm) for the supply of fuel and lumber, as well as for shelter and ornament, ought not to be overlooked, and that the state of the woodland should receive, in these competitions, all the attention that it deserves.

IV. *Resolved*, that the thanks of the American Forestry Association are hereby presented to His Honor the Lieutenant Governor and other officials of the Province of Quebec, and also to the city authorities, for the courtesies extended to its members, and for their promotion of the objects of the association, and

V. *Resolved*, that the thanks of the American Forestry Association be presented to the Reception Committee and to the citizens of Quebec, for the hospitalities so courteously granted.

The report of the Committee and the resolutions therein contained, were unanimously adopted.

The Hon. J. K. Ward then read a paper entitled "Reminiscences of the Lumber Trade of Canada." He said that about fifty-two million acres of timber land were held by the Dominion Government under the license system, and estimated that the supply of lumber would last thirty-seven years at the present rate of cut.

Dr. Peter H. Bryce then presented a paper on "Forests in their Relation to Health."

It was moved and seconded that a vote of thanks be given to Dr. Bryce for his interesting paper; carried.

Mr. George Moore read a paper on "Shade and Ornamental Trees in Cities."

Papers by Mr. H. B. Ayres, of Minnesota, entitled "Minnesota Woodsmen," and by Mr. J. C. Chapais, on "Forest Preservation and Restoration," were read by title.

On motion of Mr. J. D. W. French, of Massachusetts, the Report of the Executive Committee was adopted, and the question of the publication of a report of the meeting referred to that committee.

A letter from Mr. W. A. Stiles, Editor of *Garden and Forest*, asking the Forestry Association to interfere for the protection of the big trees in Tulare County, California, was read. (See recommendation embodied in Special Committee's Report.)

A letter from Colonel Thomas T. Wright, of Nashville, to the President, suggesting the desirability of enlisting the support of the women of the country in the cause of Forestry, and forming an Association of Daughters of Forestry, and also of holding a meeting in Chicago during the season when the World's Fair was in progress, was read, but no action was taken thereon.

It was moved that a vote of thanks be tendered to the Hon. H. G. Joly for his unselfish devotion to the interests of the Association during all its sessions in Quebec, and for his unwearied kindness and courtesy.

Professor W. R. Lazenby, Mr. Fernow, and General James Grant Wilson all warmly seconded the motion. Carried.

The meeting then adjourned to meet again at the call of the Executive Committee.

Numerous courtesies were extended to the members of the American Forestry Association, during their stay in Quebec. On Tuesday afternoon, September 2d, Mr. J. M. Le Moine took a number of the delegates to the Laval University, and showed them the interesting natural history collections and the picture gallery. On Friday, September 6th, the members of the American Forestry Association and the members of the Alpine Club of France were taken on board the steamer "Druid" (placed at their disposal by the Dominion Government), and proceeded down the St. Lawrence to the Island of Orleans, paying a visit to the Church of St. Anne, to which pilgrimages are made, and were hospitably entertained on board by the Corporation of the City of Quebec.

Before parting, the members met once more to plant on the Parliament grounds two hickory trees from General Andrew Jackson's place, which had been sent from Tennessee by Col. Thos. T. Wright, with the request that one of the trees should be planted in honor of Lord Dufferin, late Governor-General of Canada. The other tree was planted in honor of Mrs. B. E. Fernow, in acknowledgment of the great services rendered by her husband to the cause of Forestry in America.

HENRY M. FISHER,
Acting Secretary.

ANNUAL MEETING,

HELD IN WASHINGTON, D. C., DECEMBER 30TH, 1890.

Morning Session. The Association met at the Department of Agriculture at 10 A. M.

Members were present from the following States:

Colorado. George H. Parsons;

Connecticut. Dr. B. G. Northrop;

Massachusetts. Thomas H. Appleton, J. D. W. French, N. T. Kidder;

New York. Hon. Warren Higley, Hon. John A. King, Henry E. Pellew;

Pennsylvania. Charles C. Binney, Rev. Alfred L. Elwyn, J. Rodman Paul, Gifford Pinchot;

South Carolina. Prof. H. A. Green;

Vermont. Hon. Joseph Battell;

District of Columbia. H. B. Ayres, Edward A. Bowers, Dr. N. H. Egleston, B. E. Fernow, Hon. Edwin Willets, Assistant Secretary of Agriculture.

In the absence of Gov. Beaver, President, Dr. B. G. Northrop, one of the Vice-Presidents, presided.

Letters from Gov. Beaver, Hon. H. G. Joly, of Quebec, and Hon. G. W. Allan, of Toronto, regretting their inability to be present and expressing their great interest in the Association, were read.

The minutes of the summer meeting of the Association at Quebec were read in part, when, on motion, their further reading was dispensed with.

A committee on resolutions and the nomination of officers, consisting of Messrs. French, Parsons and Green, was appointed.

Most of those present not having attended the Quebec meeting,

the Report of the Executive Committee, presented at that meeting, was read by Mr Binney, and followed by a supplemental report.

Supplemental Report of the Executive Committee.

To the Members of the American Forestry Association :

Since the report presented at the Quebec meeting was written, there have been thirty accessions to our numbers, which now reach 225, distributed through thirty states, one territory, the District of Columbia, and the provinces of Ontario and Quebec. The Association has sustained a serious loss in the death, on Sept. 30th, of Hon. Frederick R. Billings of New York and Woodstock, Vt., a valued member for several years past.

To look back nearly nine years, to the formation of this association at Cincinnati in April 1882, is not at first a cheering retrospect. The need of state and national legislation for forest protection and management was so clear that had any one then said that by the end of 1890 the state of New York alone would have even the beginning of a system of forest preservation, he would have been thought most despondent. Yet after all these years of work for forest reform we seem to stand just where we did in 1882, while the evils confronting us have intensified. In reality however, our position is very much stronger than it was then, for the people are gradually coming over to our side. In 1882, the American people as a whole cared little for forest preservation, either for economic reasons or as a matter of taste or sentiment. In 1890 it is undeniable that they are becoming concerned about the timber supply, as the changed tone of the lumber trade journals and the press in general clearly proves. It is felt that something more is needed for permanent lumbering than merely to cut down all the trees in sight, and that there must be some change from the old ways ; hence practical suggestions in the way of forestry are listened to and quoted, even if not as yet to any great extent followed. There is an increased sentiment in the matter, too, which is worth something, since every human being is swayed by sentiment and taste, far more, usually, than he is aware of. Despite the intensely practical nature of the American people, the love of flowers, purely a matter of taste and sentiment, has grown immensely in this country of late years. From flowers to trees is but a step, and a most natural one, which many people have taken. And as it is with floriculture, so it is with the more practical agri-

culture. How much a farmer cares for forest depends upon how intelligently he cares for his farm, and when once the whole American people, the practical as well as those of taste and sentiment, shall thoroughly and sincerely care for trees and forests, the forestry problem will be easy of solution, for then will be enlisted on the side of forestry that will which is sure to find a way.

A most valuable agency in this direction is "*Garden and Forest*," now completing its third year. Treating all matters of the garden most ably and thoroughly, it has also been steadily sowing the seeds of forestry in ground already fertilized by a lively interest in horticulture. It is clearly hastening the day when the interests of the garden and the farm will demand forest preservation and management as essential to their own prosperity.

The meeting at Quebec, Sept. 2nd to 5th, was, owing to the distance, attended by few of our members except those living in Canada, but those who went learned something of the sincere and practical efforts now made in Canada to prevent fire and induce reforestation. The interest and encouragement due to the atmosphere of *real forestry* demonstrated the wisdom of accepting the courteous invitation of the Quebec authorities.

In New England apparently the most important work of the year is that of the forest commission of New Hampshire which has been carefully investigating the forest lands of that state in order to ascertain the tracts which most need preservation and the most practical means of effecting this. Their report written by Mr. J. B. Harrison, in 1889 the corresponding secretary of this association, will soon appear and it is hoped that the legislature will take effectual steps to prevent that beautiful, health-giving forest region, the resort every summer of so many thousands from all parts of our country, from being turned into a bare, uninteresting waste.

In New York the commission appointed by authority of the last legislature has been investigating the Adirondack region with a view to securing a large state park, so as to preserve to some extent the forests of that attractive region and protect the sources of the Hudson. A bill providing for such reservation has been prepared after careful deliberation and will be presented to the legislature a few days hence. While a few railroad and lumbering interests may be arrayed against it, the necessity for its passage is so clear that in may be looked forward to with some confidence, provided the friends of the measure are active. No good law was ever yet passed without a struggle, and laws for forest reform will be no exception to the rule.

The organization of the Adirondack League Club, owning 93,000 acres of forest in Hamilton and Herkimer Counties in the southwestern part of the Adirondack region is important as constituting the first attempt at permanent forest management in this country on any large scale. The Club intends to treat its property not only as a summer resort and hunting ground, but as a tree farm, having the ripe timber cut and sold, but so as to make way for the new growth, and not to leave the ground either wholly bare or so littered over with waste stuff as almost to invite the fire to sweep through and destroy the life of the soil. It is no flattery to the projectors of this club to say that they will do more for forest reform than many associations such as ours. We represent precept, they example, and when once they make an ocular demonstration that there is money to be made by systematic forestry, the idea will take root and spread as it has never done before. And whatever be the success of the club it will be due in great part to the work of this association. Several of the stockholders are our own members, and what they will carry out in practice is simply that principle of forest management the idea of which this association has fostered and kept alive year after year in spite of delay and opposition until now the fruits of the work begin to be seen.

In national forest preservation, the year has not been as fruitful as was expected, but yet not wholly barren. The tariff bill, the pension bill, the silver bill, the elections bill have found many and eager advocates, but a practical forest law is less loudly and persistently demanded. Still, the extension of the Yosemite Park and the reservation of the *Sequoia* tract of 3500 acres in Tulare County, Cal., are something. The latter made the Quebec resolution in part unnecessary, but as the greater number of the *Sequoia* are outside the reservation, this important fact was communicated to the Secretary of the Interior along with the resolution.

The increased appropriation to the Forestry Division will enable it to continue the experiments and investigation as to forestry and rain-fall, and the collection and distribution of valuable seeds and plants.

The Quebec report of the committee on legislation may be supplemented by saying that no forestry bill has yet been reported to the House, and that this Congress is nearing its end. Should a determined effort be made, it might even now be possible to have a bill to provide the beginnings of a forestry system reported and passed, but this is not likely. In any case, though, the attempt to secure it must be renewed and kept up. This Association has two

immediate objects in view by means of which ultimately to secure forest preservation—education, leading the public mind to see the necessities of the situation; and legislation, establishing proper methods of dealing with the situation. It would be almost as fatal to abandon the fight on the second line as on the first.

To further build up the Association and continue its work, the constitution should be so changed as to allow of additional members of the executive committee, who should be elected from among the members resident in Washington, so that the committe could meet there regularly. There might also be a sub-committee on publication and membership, a quorum of which should reside in one place. By proper system and division of labor the work would not fall too heavily on any one, and the power of the Association be greatly increased.

Respectfully submitted,
For the Executive Committee,
CHARLES C. BINNEY, *Secretary.*

The Treasurer submitted the following report:

HENRY M. FISHER, TREASURER,
in account with
The American Forestry Association.

1889	DR.	
Oct. 15	Balance as per account rendered, . . .	$2 52
1890		
Dec. 30	To Receipts from Annual Dues, . . .	383 00
"	" " " Life Membership Dues, .	550 00
"	" Contributions, ...	122 00
"	" Interest on Deposits, ...	10 13
"	" Cash for the Sale of Pamphlets, . .	2 27
		$1070 02
	CR.	
1890	By Cash, Stationery and Postage, . .	$124 67
Dec. 30	" Printing and Type-Writing . .	108 80
"	" Advertising, ...	18 60
"	" Traveling Expenses of Secretary, .	12 45
"	" Expressage and Telegrams, . .	3 30
"	" Subscription to *Forest Leaves*, .	116 00
	Balance to credit of Current Expense Acc.	136 20
	" " " Life Membership Fund,	550 00
		$1070 02

Messrs. Binney and Pinchot were on motion, appointed a committee to audit the Treasurer's account.

Dr. Northrop made a report from the Committee on Arbor Day in schools, which was very encouraging, showing that Arbor Day is now observed by schools in thirty-seven States.

By invitation Judge Higley reported upon the prospect of forest improvement in the State of New York, referring especially to the movement of the Adirondack Park Association, composed largely of business men, which proposes to have the State set aside 3,000,000 acres of Adirondack forest land and place them under proper forest administration. He also spoke of the work just begun by the Adirondack League Club, a company of private citizens who have purchased 100,000 acres of forest which they propose to maintain in its forest condition as a pleasure resort, while also so managing it as to make it a source of income from the sale of timber as it is ready for market.

At 12.30 o'clock a recess was taken until 2'clock.

At the opening of the afternoon session the Committee on Nominations and Resolutions reported a proposed amendment of the constitution so that Article 4 shall read as follows, viz :—

"The officers of this Association to be elected at the annual meeting shall be a President, one Vice-President for each State, territory, and province represented in the Association, a Treasurer, a Recording Secretary, a Corresponding Secretary, and an Executive Committee consisting of these officers and six other members. Three of this committee shall constitute a quorum. This committee shall choose its own chairman."

The proposed amendment was adopted.

The Committee then reported a nomination of officers as follows :

President.—Wm. Alvord of California. *Vice-Presidents.*—Quebec, Hon. H. G. Joly ; Alabama, Dr. Chas. Mohr ; Arizona, D. M. Riordan ; Colorado, Geo. H. Parsons ; Connecticut, Dr. B. G. Northrop ; District of Columbia, Hon. Edwin Willets ; Georgia, Hon. C. R. Pringle ; Illinois, Geo. W. Minier ; Iowa, C. L. Watrous ; Kansas, Prof. E. A. Popenoe ; Maine, Jno. E. Hobbs ; Massachusetts, J. D. W. French ; Michigan, Prof. J. W. Beal . Minnesota, Hon. C. C. Andrews ; Nebraska, R. W. Furnas ; New Hampshire, J. B. Harrison ; New Jersey, W. A. Stiles ; New York, Morris K. Jesup ; Ohio, Prof. W. R. Lazenby ; Ontario, Hon. G. W. Allan ; Pennsylvania, Herbert Welsh ; Rhode Island, L. D. Davis ; South Carolina ; Prof. H. A. Green ; South

Dakota, Prof. C. A. Keffer; Tennessee, Col. T. T. Wright; Texas, W. G. Jones; Vermont, Dr. H. A. Cutting; Wisconsin, H. C. Putnam. *Treasurer.*—Dr. H. M. Fisher, Philadelphia, Pa. *Recording Secretary.*—N. H. Egleston, Washington, D. C. *Corresponding Secretary.*—E. A. Bowers, Washington, D. C.

Additional members of Executive Committee:—B. E. Fernow, H. B. Ayres, E. T. Ensign, H. E. Pellew, Warren Higley, C. C. Binney.

The officers nominated were elected.

Informal reports as to the condition of forestal interests in several States were then made by Prof. Green of South Carolina, Mr. Appleton of Massachusetts, and Mr. Paul of Pennsylvania, which were followed by remarks from various members.

An invitation from Colorado to hold the next meeting of the Association in that State was received with thanks, and the decision as to its acceptance was referred to the Executive Committee.

The Association then took a recess until 7.45 o'clock P. M.

Evening Session.

The Association met at the designated time, at the National Museum, in joint session with the American Economic Association.

Vice-President Willets called the Association to order and made a brief address.

The Committee on Nominations and Resolutions then reported the following resolutions:

1. *Resolved*, that immediate steps should be taken to reserve from sale and entry the forest lands now under national and State control, and to so preserve and administer them as to make them a source of permanent income to the governments, and especially that the sub-committee of the Public Lands Committee of the House of Representatives, appointed to consider forestry measures, be earnestly requested to report favorably a bill for the reservation, protection and management of the forests on the public lands of the United States.

2. *Resolved*, that permission should not be granted by the United States Government for the construction of any railroad in the Yellowstone National Park; and that besides the passage of the necessary laws for the government of the said park, including the adequate punishment of offenders, the boundaries should be

extended so as to include adjacent forest lands, and should be more definitely marked.

3. *Resolved*, that this Association heartily approves of the request made by the Secretary of the Interior to the Secretary of War for two companies of cavalry to protect the Yosemite and Sequoia Parks, and respectfully urges the Secretary of War to grant this request.

The Association also urges upon Congress the desirability of farther extending such reservations as that lately made in Tulare County, and the need of extending the boundaries of Yosemite Valley Park.

4. *Resolved*, that the present efforts for forest administration and preservation in the Adirondack forests in New York and in the White Mountain regions of New Hampshire, both by the States, by Associations, and by individuals, deserve the earnest encouragement of the American Forestry Association, and that the members resident in those States be urged to co-operate with the Adirondack Park Association and the New Hampshire Forest Commission is securing the legislation needed.

5. *Resolved*, that this Association heartily advocates the establishment of forest parks by cities and towns, and especially commends the donation of such parks by private citizens to public uses, regarding them as important agents in promoting public interest in forest preservation as well as public health.

The Resolutions reported by the Committee were unanimously adopted.

Papers were then read by Edward A. Bowers, Esq., on "The Present Condition of Forests on the Public Lands," by Gifford Pinchot, Esq., on "Government Forestry Abroad," and by B. E. Fernow, Esq., on "The Feasibility of American Forest Administration."*

The Association then adjourned sine die.

N. H. EGLESTON, *Recording Secretary.*

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*These three papers will appear in a monograph on forestry, to be published by the American Economic Association. Copies can be obtained of the Secretary of the American Forestry Association.

Papers read at the Summer Meeting.*

THE FOREST AS A NATIONAL RESOURCE.

BERNHARD E. FERNOW, CHIEF OF THE FORESTRY DIVISION, WASHINGTON, D. C.

In a paper which I read before this association last year, I classified the natural resources which serve the material progress of nations, with reference to the position which the nation as a whole ought to take towards them. I endeavored to show that the most prominent functions of government in regard to these resources are or ought to be providential in their nature; that the state being in its very conception an institution to insure not only the present, but the future and continued welfare of the community, must have an interest in the permanence and proper utilization of natural resources, upon which this welfare rests.

To restate briefly the classification, we found two principal classes, namely:

(*a*) Resources which yield directly the necessaries or conveniences of life and form objects of industrial activity;

(*b*) Resources which serve indirectly the comforts of society, industry, and progress of civilization, and do not form objects of industrial activity.

It is the former class of resources mainly, which, if left to individual control, are most apt to deteriorate and in regard to which the interests of the individual and the community are most frequently at variance, and it is most difficult to find the proper balance between permissible freedom of individual disposal and necessary restriction by communal interest. In regard to the second class of resources, such as air, light, waterways, etc., the providential function of the state is much better understood and conceded, although even here the *laissez-faire* idiosynscrasists would give to individualism the widest latitude.

The resources which form objects of industrial activity were again divided, with reference to their continuity, into

1. Resources exhaustable and not restorable;

*The Publication Committee regret that two or three of the papers read have never come into their hands.

2. Resources restorable, but liable to deterioration under increased activity ;

3. Resources restorable and apt to yield increased returns to increased activity.

To intelligently define the position which the state should take in the matter of protecting its resources against too rapid exhaustion or unnecessary deterioration, we must keep always in view the implied interest of the state in the future, and understand the nature of the resource, with reference to its future. In this paper it is proposed to define the proper position of the state towards its forest resources, and for this purpose to investigate the nature of these resources.

It is questionable whether the forest itself may be considered a resource. It is in reality a crop, a product of the soil ; and the soil with its fertility is the resource proper, which can be turned to this use or to any other. The forest primeval is nothing but a function of the fertility of the soil. As soon as the soil is not needed for other purposes more useful, this product of the soil may be valuable, and with means of transportation to a distant market, or as far as a home market exists, it may constitute a resource. As soon as with increasing population and hence demand for food-producing areas the occupation of the soil by wood-growth is a hindrance to its agricultural use; (and by this antagonism the value of the forest resource is apt to depreciate in proportion to the need for food areas) the wood product may become the opposite of valuable by necessitating its removal without a market for its disposal ; hence the burning log-pile of the pioneer settler, fed by the most valuable timbers. The need for cleared lands tends to diminish the occupation of the soil by wood-growth, until at last an equilibrium results, when the needs of food areas are satisfied and the requirements of wood material make a reservation of soil for forest growth desirable. When at last the stores of the virgin forest are exhausted and it becomes necessary to apply human ingenuity and management to the production of desirable quantities and qualities of wood material on a confined area, a new industry, forestry or forest management, arises, which exercises itself, like agriculture, upon the production of values from the soil.

So long, then, as the virgin forest is not placed under management, its stores represent the resource itself, and, being worked somewhat similarly to mines, it is an exhaustible resource, differing, however, from mines in its capacity of being reproducible. As

long as the activity in working the forest is simply directed towards the extraction of the valuable material which nature has stored up for centuries, every increase in this activity means corresponding depreciation and depletion of the resource. As soon as the forest becomes an object of scientific management, and artificial forest planting is resorted to, it is the soil and its fertility which is the actual resource, the tree-growth being a product of the same; and then we may range it under the third class of resources, which yield increased returns to an intelligent increased activity, this activity being exercised not in the direction of utilization but of reproduction.

While the virgin forest is worked, as it is in the United States and Canada, simply taking out the material wanted without any regard to its continuance, it represents, as has been stated, almost like a mine, an exhaustible resource; for although reproduction is possible, and in reality occurs, under these reckless methods of utilization, not only is the reproduction very partial, but where the better kinds of timber are culled the reproduction can only be of inferior kinds, and the quality of the resource is therefore reduced. In addition to the irrational method of utilization, which tends to deteriorate the resource, the disastrous fires which overrun the forest areas of the United States annually destroy the accumulated leaf-mould of centuries, thus reducing the fertility, killing the young growth, and especially on the hillsides and mountain slopes where, by the baring of the ground the beating rains are allowed to wash off the soil, making reforestation almost impossible, so that in the end the resource—whether the growth be considered as such or only the soil and its fertility, is exhausted.

But besides furnishing directly wood and incidentally other valuable products, which either as raw material or in manufactured form supply a large number of human wants, the forest at the same time by its functions in the circulation of air and water exercises an influence upon cultural, climatic, and sanitary conditions, which classes it to that extent with those resources, which, like air and water itself, are, though indirectly yet most indispensably connected with material and cultural progress, and are of the greatest interest to the nation; so that in considering the position of the state towards forests and forestry, we will have to keep in view these two aspects of the forest—its material value and its cultural function.

The value of any material resource is measured, in the first place, by its comparative abundance. Other factors which enter

into the valuation are the demand for it, the ease with which it can be obtained and brought to centers of consumption, the possibility and ease of reproduction, and its necessity for our present civilization or more or less easy replacement by other materials may also influence the valuation.

1.—The Forest as a Producer of Material.

As regards the natural reproduction and the consequent abundance of the virgin forest, it may be said that the whole earth is a potential forest. That is to say, with the exception of a comparatively small area—in elevation above timber-line, in north and southward distribution beyond eternal frost line, in continental distribution within rainless deserts and soilless rocks—tree growth would ultimately prevail on the entire land surface, provided the interference of animal or human life were checked.

This interference, however, has reduced the forest area in all parts of the world. It has, no doubt, been largely instrumental in creating the vast prairie regions and treeless plains which are found on every continent, and which, but for the continued interference, would gradually, at least within geologic ages, reclothe themselves with tree-growth, with few exceptions. If originally the land area represented an almost uninterruptrd forest area, animal and human activity has changed the face of the earth considerably. This change has taken place partly to satisfy the needs of increasing masses of population for food areas, partly without such need, by reckless destruction; so that density of population cannot alone account for present distribution of forest areas, but the historic development of the people, their progress in civilization or relapse into comparative barbarism, and the natural conditions of the countries have had a bearing.

Thus, while Norway and Sweden, with scanty population, showed until recently, when an active export business of wood reduced their forest areas, a large proportion of woodland; in Spain and Greece, although the population diminished with the decline of culture, reforestation has not increased in proportion, and we find a small forest area together with scanty population. In Germany, economic development and early recognition of the value of the resource, and the necessity for its rational use and management, has preserved a proportionately large area. In the United States the proportion of forest area to population since its settlement by

European races has rapidly declined. Here almost one-half of the continent had by adverse climatic conditions, supplemented probably by the destructive agencies of beast and man of earlier civilization, been deprived of its tree-cover. To such an extent has human activity reduced forest areas that in those countries where it has been most active the proportions have dwindled down to even three per cent. of the land area. Taking Europe altogether, not much over thirty per cent., or two and a half acres per capita, remains in forest, and in the United States the forest area represents probably not more than twenty-five per cent., or seven acres per capita of population.

The demand for forest products is perhaps nowhere greater than in the United States, probably not less than six to eight times as large as in Europe.

In Germany, with a population at least twelve times as dense as the United States—and hence the need of strict economy with all exhaustible resources—the annual consumption per capita may be set at about 45 cubic feet. The annual production of the well-managed forest areas of Germany is found to average 55 cubic feet of wood per acre; there should, therefore, be 0.8 acres per capita, which very nearly is the case, (0.79 acres), the small deficiency being made up by imports, the excess of imports over exports being about 60 million cubic feet. In the United States we use simply the accumulation of material through centuries in the virgin forest, the second growth furnishing but a small part, and of management for reproduction or increased yield there is as yet no sign.

In the virgin forest the product per acre varies to such an extent that it would be impossible to make even a reasonable guess as to available supplies; some of the pine forests of the South may cut no more than 200 or 300 cubic feet, while some areas on the Pacific Coast may yield 15 to 20,000 feet and more. If we apply the experience of Germany as to possible annual wood production per acre, we will find that our present forest area, if properly stocked and well managed, would suffice to furnish our present demand of 20 to 25 billion cubic feet. But we know that the premises do not exist. The manner of utilizing the product has also much to do in calculating the efficiency of the producing area. While, for instance, in the forest management of various German States the percentage of entire wood material may be said to be utilized in some shape or other; in the United States a very large

part is not utilized at all and left in the woods; and while in the German forests from 40 to 65 per cent. appears as building timber, we learn that less than 30 per cent. is the yield from the red woods of the Pacific Coast; and, take it all through, it is doubtful whether more than 25 per cent. of the actual wood in a tree is utilized in the United States.

In comparing supplies and demand, it would be a mistake to place reliance on calculations of the wood accretion upon the areas under forest cover, for it is quality of material that is demanded, and not mere quantity. Not only do areas differ in their wood-producing capacities according to climatic and soil conditions, but their composition as to kinds of trees and quality of timber determines their value. Thus, while the area of forest in the United States probably does not diminish now at as rapid a rate as it used to, the value of the remaining area is very rapidly depreciated, not only by removing the accumulated supplies, but by culling the best and leaving the inferior material, by neglecting to give attention to the reproduction of the better kinds, or even by recurring fires destroying the capacity for such reproduction.

The forest furnishes firewood, building timber and raw material for the arts.

In the United States more than three-fifths of the population uses wood exclusively for fuel, and to show the value and appreciation of this class of fuel in comparison with substitutes, it may be mentioned that in Germany during 75 years from the beginning of the century the price of coal has constantly sunk, while that of charcoal has constantly increased; showing that the substitute not only did not displace, but did not even affect the valuation of wood as fuel. The bulkiness of the material when compared with its heating power is objectionable, but other qualities make it desirable.

For building purposes, although stone, iron and other materials are used more and more, the ease of shaping wood material, the rapidity with which it can be handled, and various other qualities, will insure the use of wood for that purpose for all time. In the arts the same qualities make the use of wood desirable; and while substitutes in many cases are even preferable, in others the necessity for using them would entail grave inconveniences. The value of sawed wood material in the United States is calculated as round one billion dollars, representing an enormous amount of material. One of the drawbacks of the material is that it is comparatively

bulky, and hence it is desirable not to have to transport it too far, especially overland, but to produce it near the centres of consumption. In the United States, with many thousands of acres of virgin timber to draw upon, the price for lumber represents hardly more than the expense of getting it out and transporting it, the material itself not representing as yet any cost of production.

II. The Forest as a Condition of Culture.

The value of forest areas in influencing climatic soil and water conditions has been generally recognized only during the last hundred years.

While there exists, no doubt, under given conditions, a relation between forest-cover and climate, all generalizations in this respect must be taken with caution, until more proof and exact data is brought by scientific methods. Climatic conditions are, in the first place, due to cosmic and terrestrial influences. Of the terrestrial influences we know mountain ranges and water surfaces to be powerful. There is reason to believe, and some definite measurements sustain the belief, that as far as forest-cover interferes with insulation of the earth and the movement of air currents it renders the climatic conditions within its own borders different from what they would be were the forest-cover removed. The doubt can exist only as to whether and to what extent this difference can make itself felt outside of the forest. The claims are, that a forest-cover tempers like a water surface, and, to some extent, intercepts or reduces the force of hot and cold winds with all the consequence of such action; further, that it influences, if not the amount, yet in local and temporal distribution the precipitation of rain and snow, besides exerting various minor influences.

Whatever the truth—and neither the claimants nor the objectors to forest climatic influences have brought incontrovertible proof—it is evident that the extent, composition and location of the forest must have much significance in the matter, and also that the relation of the country towards other climatic influencs must either increase or decrease the significance of this factor as a climatic element. In England, under powerful terrestrial tempering influences, any forest influence would be inappreciable by comparison; poor thirsty Spain, on the contrary, deprived by its situation of the effects of modifying ocean currents, might possibly modify the extremes of temperature under which it suffers by extensive forest

areas, which it lacks. While our own North Pacific coast, if stripped of her wonderful forest wealth, would not be appreciably deprived of its abundant rainfall brought by the ocean currents; properly disposed timber-belts in our arid and sub-arid interior might, if they did not increase precipitation, at least check the excessive evaporation under which it suffers from incessant and unchecked winds. The cool and humid forest-cover situated on the slope toward the moisture-bearing winds may unnecessarily increase the tendency to condensation to which the currents by their mere descent are subject; while if situated on the leeward side, it might recuperate itself from the moist forest air, the drained current coming over the mountain. Here, by obstructing the gentle south wind, it may keep a valley longer in the rigors of winter; there, by cutting off the cooling breezes, it may make less bearable the heat of summer. So that an objectionable influence may be shown as well as a favorable one, according to local conditions.

With more assurance can we speak of the influence which the forest-cover exerts upon the soil and water conditions. Again, it is the location with reference to the configuration and geologic formation which imparts the value to the forest, and hence, again, generalization is not permissible. Here, where an excess of moisture due to subsoil conditions used to be removed by the process of vegetation, deforestation induces the formation of marshes, and in consequence unfavorable sanitary influences on the surroundings may result; there, under different conditions, where evaporation had been checked by the forest, its removal reduces the humidity of the soil and the size and continuity of springs. Remove it from the shifting sands of the coast and the formation of sand dunes encroaching on the agricultural lands is induced; burn the forest floor on the sandy gulf coast plains and you destroy its fertility; burn the litter that accumulates under the forest-cover on the mountain slopes and the waters will run riot and gully the ground; torrents, landslides, snowslides, avalanches are induced, washouts filling the valley and the river with debris, causing stow-waters and increasing, if not producing, floods. The significance then of the forest under given conditions as an important factor in the general conditions of a country cannot be denied.

Lastly, when we consider that forest-growth is capable of producing values on ground which cannot be utilized profitably in any other way, its significance as a national resource may be considered sufficiently established by this brief exhibit. This latter capacity

of forest-growth is of the more significance when we look over the world and count the waste places which man has produced. There are in France and Germany alone over 500 square miles of sand dunes, which France has shown, by a reforestation of nearly 300 square miles, can be profitably utilized. In Austria the waste places capable of reforestation are nearly 2,000 square miles; in Italy, 1,500; in France, nearly 10,000 square miles; in Great Britain and Ireland, over 11 per cent.; in Greece, over 15 per cent. of the area is waste, while in Germany only 2.7 per cent. Hence, of late, all these governments strive to bring these vast unproductive areas into useful occupancy. Prussia spends $250,000 yearly in that direction. France has spent round $30,000,000 within the last 25 years in recuperating devasted forest areas, and even Russia has, since 1843, reclothed over 50,000 acres of her steppe.

We have seen that, as a meteorological and cultural element, the location of the forest is all-important, and its most pronounced value as such element is found on the mountain-sides, on shifting sands and on the poorest soil, in general; that is to say, those locations where the material product must be necessarily inferior to that of better situations and where, therefore, forestry is least profitable. They are the very areas where private activity can find satisfaction only by reaping the natural crop. Yet here the danger from mis-management—that is a management in which no regard is taken of the simultaneous or immediate reproduction when the crop is harvested—must be the greatest, since the baring of the slopes and sand soils may mean destruction of fertility, not only of the bared but also of the adjoining areas, and increasing dangers from flood waters. Hence the interest of the community must be centered upon these forest areas.

It has been contended that the reproduction of forest-growth takes place of its own accord, and hence the interest of the State as far as material production is concerned, need be only of that general character which it has in all products and industries of the nation. This contention, however, is erroneous, if considered from an economical point of view. While culled and denuded areas do reproduce a wood-growth, this—in quality and especially in quantity per acre—is only in rare cases satisfactory and economical. The reckless squandering of material, the disregard of the condition of the area after being left by the lumberman, the practice of firing, and thereby destroying the young growth as well as the fertility of

the soil, are to a large extent detrimental to the reproduction of the resource, and experiences all over the world have shown that by such reckless policy recuperation can be rendered almost impossible.

As far as the production of material constitutes the forest a resource, it is not tree-growth merely but quality of the growth that makes it valuable, just as it is not the presence of iron but its sufficiency and quality in the ore, that makes the iron mine of value. The forest primeval contains much material which is of little or no value, and large areas are required to produce small amounts of good timber, but in its reproduction it can be improved in value and yield, and that without anything but proper use and management. The forest differs from agricultural and horticultural products of the soil in so far as the latter are usually improvements upon the natural product in kind, by human ingenuity and labor, while the natural product as found in the virgin forest satisfies the needs of man.

An important difference, too, and one which makes the use of the soil for forest growth as an economical element desirable, is, that while agricultural crops exhaust soils of their fertile elements, wood-growth does not rely on these to any extent, returns the larger amount of those utilized by the fall of leaves and branches, and improves thereby the soil for agricultural use.

The production of starch or sugar, and albuminoids, which is the object of agriculture, takes place at the expense of the minerals in the soil which are carried off with the yearly crop, while forest products, being in the main cellulose and its derivatives, are formed at the expense of the inexhaustible carbon of the atmosphere; and, although small quantities of the rarer minerals are also required, they are used over and over again for processes of assimilation from year to year, since the crop is not removed annually; and when it comes to harvesting, those parts of the tree which contain most of these minerals, the foliage and litter, remain on the ground. Thus a potato field for a medium crop requires three times as much of the rare phosphoric acid as a beech growth, five times as much as a spruce forest, and nine times the requirement of an acre of pine, while the consumption of potash is nine, thirteen and seventeen times, respectively, as great.

Hence the capacity of forest growth to utilize those soils which have been exhausted by agricultural use; and by the deep going roots mineral elements are raised to the surface and the soil improved. Forest growth makes also less demand upon favorable

topographical and climatic situation, and will succeed where agriculture is no longer profitable or is impossible. Hence we may speak of absolute forest soils, that is soils which on account of their poverty, steep topography and climatic ill-favor are not fit for anything but forest-growth. The extent of what can be considered such absolute forest soil depends somewhat on the state of culture of the country. But it is a fact of highest national interest, that inferior soils and impracticable sites can be profitably utilized by forest-growth.

The main difference between forestry and other productive industries is the long period of production. From the time of planting to the time of harvest many decades may pass and a century may not be too long. As long as it is not only wood, but size and quality that is wanted, the factor of time is an important one, for it takes time to produce both size and quality. There are, to be sure, some uses for which timber may be grown in short rotations, as, for instance, where only firewood or posts or tanbark is wanted, but these uses are confined in extent.

When we consider not merely the virgin forest growth but a rational forest management, we find that it differs from agriculture in various financial aspects. In agriculture the soil alone is the standing capital or basis of production from which annually the interest is derived in the crop. In forestry the soil, plus a certain amount of growth, is the producing basis ; only a part of the growing crop can be utilized annually, the rest, remaining for further accumulations, must be considered as part of the fixed capital. This condition at least prevails where an annual revenue is to be derived from the business. It is of course possible to work for an intermittent revenue, waiting until the entire growth has reached the age for utilization, and after harvest starting the new crop for another rotation ; but this is not the most profitable way, and in the end it may be irrelevant financially, whether we conceive the growing crop partly as a capital or simply as an accumulation of revenue which we may not utilize. To make a regulated forest management possible and profitable, to yield sufficient annual returns and to occupy the manager fully, a larger extent of territory is required than in agriculture ; hence a larger standing capital is required. Agriculture, on the other hand, while needing comparatively small fixed capital, requires a comparatively larger running capital for expenses.

The existence of this stock in forest management places it in a

particular position with reference to insurance and credit systems and the question of renting. There are dangers threatening this stock which make forest property hazardous, more or less so according to locality, kind of timber, kind of management and moral sense of the population. In the United States the danger from fire makes forestry one of the unsafest industries, and theft, it would appear, endangers it about as much. Insect ravages are the bane of the cultivated forests of Europe. But what they will be in the United States—the El dorado of vermin—when forest management has begun in earnest and the damage is felt more severely, is hardly conceivable.

The damage differs in value with the age of the growth. Fire may destroy the accumulated stock and crop of centuries ; insects may destroy the saplings, and grubs kill the young seedling growth. Windfalls or tornadoes may interfere with the regular system of management and may make a utilization of the stock necessary before its maturity, and thus occasion an overstocking of the market and decline of values.

While there are some dangers in agriculture, such as unfavorable weather, frosts, etc., that are not at all or to a less extent felt in forestry, it is there only one year's crop that suffers, while here accumulated stores are exposed to hazard.

Since the main value of forest property lies in the accumulated stock, the soil being mostly of inferior value, and this stock is most exposed to depreciation and depredation, it does not form a fit object for credit, nor is it for the same reasons a desirable property to rent. The stock is all the year round exposed to the depredations of others, hence it requires a comparatively large expenditure for protection simply. The existence of this stock is also apt to prove dangerous as far as the proprietor himself is concerned, for it offers a constant temptation to utilize it at the expense of a rational management. Necessity, folly, or miscalculation may easily diminish it, while to place it again upon its proper value and quantity is difficult. Hence, if it is in the interest of the community to maintain stable conditions of property, or where the forest partakes of the protective quality, more special care in regard to the laws regulating forest property seems necessary.

Roscher says :—

" Where the sale of property becomes jobbing, *i. e.*, where it is purchased not to be managed, but to be sold as soon as possible for the purpose of pocketing the difference in price, agriculture

declines ; but with forests such abuse of property in soil is much more dangerous on account of the characteristics of forest management, so that here slow change of proprietorship is proportionately much more advantageous."

The labor conditions in forest management are also worthy of note. Less labor is required here than in agriculture, since cropping and harvest recur only at the end of the long period of rotation, and the work of cultivation is connected mainly with harvest of material. Yet while few laborers are needed for their full time a large number is given work at a time when work in agricultural pursuits is slack. According to statistics from German Government forests, agriculture employs from ten to even thirty times as much labor per acre as forestry ; of the class of foremen, inspectors and similiar occupations, one man is needed for every 200 or 300 acres in agriculture, while to one forest-guard 500 to 1,800, and to one district-manager 5,000 to 15,000 acres are calculated. Altogether, the forest offers less employment to labor than agriculture ; the factor of nature has more sway in it. This may have been the reason, why everywhere, the idea of private ownership in this kind of property has developed slowly and less regard is paid to property rights in it.

Further differences between agriculture and forestry are found in the conditions of transportation and market. The bulkiness and heaviness of the material make transportation difficult and comparatively expensive, so that the cheaper grades, especially firewood, may not be profitably utilized. It has been figured out by a good mathematician (Little) that if it were necessary to convey the amount of timber annually consumed in America from foreign ports, the entire sailing tonnage of the world would be required. With undeveloped means of transportation, the market for wood is locally circumscribed, and hence unprofitable, an intensive utilization of the crop is precluded, and the best management often impossible.

As to profitableness of the business, this depends on so many factors and conditions that it cannot be easily determined in a general way. Although the profit per acre resulting from European forest management seems exceedingly low, it must not be forgotten that this profit is derived from the poorest soils and with little expenditure of working capital. In Prussia, for ten years, the revenue for the entire forest area of the Gevernment was $1.92 per acre ; in Saxony, $5.60 ; in the very profitable forest manage-

ment of Zurich, $6.45; and on about 10,000,000 acres of German Government forest areas, it averaged $2.89, while agricultural land brought, according to crops, from $8.75 (buckwheat) to $96.00 (tobacco) per acre, annual income. Excepting, therefore, the poorer soil and special conditions and kinds of management (for instance, coppice management of short rotation for tanbark), agriculture is more profitable. During the long time necessary for production in forestry, the conditions may moreover change to such an extent that what appeared a profitable undertaking when begun, by change of circumstances becomes unprofitable. The difficulties in gauging and balancing supply and demand may also be considered greater than in agriculture. On the other hand, the possibility of delaying the harvest or cutting it earlier, according to market conditions, is an advantage in forestry. It is also possible to store the harvest without the detriment or expense which agricultural crops would entail.

Since forest management does not admit of rapid changes in plans and method, but requires a conservative and well-matured plan, not only should the forest manager command a considerable scientific education and knowledge, but he must have a determined character which is capable of carrying through a policy upon which he has decided. Forest management implies and fosters stability and conservatism. Having conceived the state as an association for the purpose of regulating and adjusting the differences of private and communal interests and rights, and having agreed that the preservation of favorable conditions for associated life, the interest of the future community, is as much the concern of the state as the protection of the present community; we may now more specifically define the position of the state with reference to the forest resources.

The state must be guided by the principle, that as much latitude should be left to private activity and property rights as is compatible with the interests of the community, only when this activity and exercise of property right is demonstrably and directly harmful to communal interests is state interference called for. The individual must be guided by the familiar legal maxim, "*Sic utere tuo ut alienum non laedas.*"

With increasing population and more complex civilization, the friction of contending interests must grow more pronounced and more frequent. As elbow-room gets scarcer, elbows more frequently knock against each other and poke into the sides of neighbors.

Hence more points are discovered where interests are at variance, and the principle of preventing the use of private rights to the detriment of the community needs to be more carefully enforced.

While with a large virgin forest-resource to draw upon and a small population, in the United States the government paid but little concern to the disposal of forest land and forest supplies; with a reduction of the latter and with increased requirements for the same, at least such ameliorative government action is called for as will aid private interest to utilize the resource more rationally and to better advantage for continued yield and future supplies. Since, in most cases, the resource is capable of restoration, the widest latitude to private activity should be granted, and the office of the state should be mainly directed to remove hindrances to a full development of a rational forest management and offer such positive encouragement as can be given by proper protection, by fostering educational agencies, and in similar ways. The state agencies which are employed to facilitate a knowledge of market conditions for agricultural crops and of crop areas are, perhaps, still more desirable in the case of forest areas and cut and demand, since it is more difficult to determine these.

As far as production of wood material is concerned—a profitable private industry—and the use of the soil in the most profitable manner, it may be presumed that private interest is identical with that of the community and will adjust itself accordingly; although this axiom can hardly be said to be recognized everywhere, as the poor mountain farms in the Adirondacks and elsewhere show. It will, however, have been observed that the nature of forest property to forest management is such as to make large and continuous holdings desirable. Hence, if the state—the community at large—does not itself retain the ownership of its forest area, it should encourage the aggregation of large forest areas in the hands of strong capitalists, individuals or corporations.

The providential and restrictive function of the state is first called into play when, by the wrong treatment of a forest, a neighbor may be injured in the enjoyment of his own property, or when the cultural conditions of whole sections of country are endangered by the free exercise of property-rights on forest areas. Whether such injury is done or is to be expected from the unrestricted exercise of private rights is often difficult to determine. Our knowledge of the relation of natural agencies is by no means so well established as to allow us definite prediction. On the other hand,

there are certain conditions under which the consequences of forest destruction or forest devastation are so well understood that state supervision in one shape or other can reasonably be claimed to be rational.

The effect of the deforestation on sand dunes has been experienced in Southern France and elsewhere to the fullest extent; just so the effect of mismanagement and deforestation of steep mountain sides, which demonstrably give rise to the pauperization of whole districts and communities, by washing off the soil, irregular water flow and increased flood dangers. Climatic influences, with the exception of reducing the detrimental action of winds, are perhaps less easily demonstrated.

Such forest property, then, cannot be left to the absolute control of the private owner. Since, however, he should be compensated for the restriction which he has to suffer for the public welfare, and since the damage done or to be expected may not always be easily proved or estimated in its extent and amount, the only proper solution is state ownership of the property. And by state ownership I do not mean to imply that the state or the general government should necessarily be understood; I mean the community—be it state, county or township—the interests of which are at stake as against the private interest. To be sure as a rule, it will be found that the interest of several towns, counties, or even states are concerned in the control of private occupancy, and the strong, immutable, conservative central government will be found the best agency to control or own the mountain forests at least. Such ownership has the advantage of securing the object in view, while any restrictions of private rights are cumbersome and dfficult to enforce. Besides, as such forests are situated mainly on the thinner soils, and rugged slopes of mountains, and, hence, are not only less profitably worked, but their reproduction is connected with difficulty and, if improperly treated, may become almost impossible; they form a questionable object for private industry in which financial gain is the leading principle.

The states which have recognized most fully the need of Government control of the forest resources are the English colonies—notably those of Australia and India—states from which we can learn a good deal in methods of internal improvements. They have done more than consider the protective function of the forest, they have recognized that the uncertainty and great fluctuation of supplies which, on account of the peculiar nature of forest property, must result from private forest management, is undesirable,

and hence have reserved large areas and placed them under government management. All other civilized governments, excepting those of the American continent, have more or less applied the principles here laid down. Canada, while disposing of its forest supplies to private individuals, does so under restrictions, and reserves at least the land; Germany, with 32.2 per cent of state forest, 18.7 per cent. of communal forest, and 30 per cent. of the private forest under more or less state supervision, thus attempts to keep secure 65.5 per cent. of her forest area. Austria, France, Italy, Switzerland, all having state forests, also control the management of their protective forests, and the tendency everywhere is to enlarge the restrictive power of the state.

While here state-ownership and restriction of private rights is directed toward maintaining favorable forest conditions, the reforestation of devastated and treeless areas forms also a proper subject for the state. Such state action of an ameliorative nature would be based upon the principle, that the community should act where the exertions of the single individual or even voluntary association of individuals is powerless, or private interest does not find sufficient inducement to attain an important economic object, where the communal interest is better subserved by the action of the state, when permanent institutions are to be created and managed independently of personal whim, and the state alone can insure permanence, continuity and the accomplishment of the object. Hence the reforestation of the Western plains, for purposes of ameliorating cultural conditions, would be properly delegated to the state, especially as long as the state still controls the land necessary for such forest planting. Feeble attempts to encourage private enterprise in that direction have been made with little result, and much of the private energy expended upon the problem has been dead loss to the individual and to the nation, for the reason that only by concerted action on a large scale is successful reforestation in the arid regions to be expected.

The method of assisting private enterprise, in any other way than by creatiag opportunities, is the least commendable, creating as it does a paternalism which would be a bane to the development of proper self-government, and which is widely different from the communal spirit which the writer has advocated in his propositions.

Summarizing the special considerations and peculiarities pertaining to forest growth and forestry which may influence state action, they can be briefly stated as follows:

1. By its location upon mountain slopes, sand dunes and otherwise, the forest may represent a climatic and cultural condition of paramount importance, which renders its material value a secondary consideration.

2. By mismanagement or neglect the capacity for reproduction may be injured to such an extent as to make reforestation impracticable, if not impossible.

3. Forest growth improves instead of exhausting the fertility of the soil, and is capable of producing useful material on the poorest soils and sites.

4. By proper methods of utilization alone reproduction of the virgin forest superior in quality and yield can be effected.

5. Forestry differs from other industries in the long period of production, necessitating an accumulation of stock, which is exposed to various dangers for a long period of time, and hence renders the business hazardous.

6. Forestry requires large areas and a large fixed capital, but only small running capital. It employs little labor, but furnishes employment at seasons when elsewhere labor is less needed.

7. As a financial investment, forestry is beset with many drawbacks, which render it less desirable for private enterprise; the necessity of keeping on hand a large stock exposed to danger renders it not a desirable object for financial operations.

8. Forestry engenders and requires permanence, continuity of plans, management and conservatism.

REPORT ON THE ADMINISTRATION OF THE PUBLIC FORESTS OF QUEBEC.

E. E. Taché, Deputy Commissioner of Crown Lands of the Province.

The general administration of our woods and forests is not, in its main features, peculiar to the Province of Quebec, and, as it originated long before the Confederation, it is on the whole the same as that followed on the Dominion lands, in Ontario, and to a certain degree in New Brunswick.

With few exceptions in this country, the interest of colonizing the wild lands of the Crown and that of utilizing the products and resources of the forests for trade and commerce, have always been kept distinct. That is to say, the right to cut timber over the Government lands is granted by a permit to that effect, in the nature of a lease, but not, in any way, conveying permanent territorial concession. As the lots located for settlement are often derived from a territory under permit to cut timber, the interests of settler and lumberman sometimes conflict; and the desire to reconcile both interests has caused the enforcement of a few laws which are not always easy to apply for the benefit of all parties interested.

On June 30, 1890, the wooded lands subject to timber license covered an area of some 50,119 square miles, equivalent to 32,076,160 acres in superficies, eighty per cent. extending over tracts not as yet subdivided into townships and consequently not, for the present at least, exposed to the inconvenience just alluded to.

The territory subject to license is sub-divided into limits or timber berths, generally resting on a river or water course, having a front of ten miles by a depth of five. Latterly, to satisfy the demand, the sub-divisions have been reduced in area—from twenty to twenty-five miles—and a more regular form has been followed irrespective of the river frontage.

The right to cut merchantable timber over a specified area is authorized, controlled, and governed by the provisions of the 23d Chapter of the Consolidated Statutes of the former Province of Canada, as now amended and contained in our Provincial Statutes, in articles 1309 to 1352.

Since 1872, this privilege is acquired at public auction only, after due notification inserted in the Official Gazette and the principal leading newspapers, and, when adjudged to the highest bidder, is conveyed by a license renewable each year, on the accomplishment of certain strict obligations. The charges consist in the price of purchase and of the first year's ground rent, $3.00 per each superficial mile contained in the limit or berth acquired, and, for its yearly renewal, that of the annual rent and of the stumpage dues levied on the quantity of wood goods that may be derived therefrom each season.

The timber dues, according to the regulations now in force, dated February 3d, 1888, for the staple of production, are the following:

Pine, birch, basswood, cedar, spruce, elm, ash, tamarac and all other square timber, per cubic foot, . . . 2 cents.

Pine, sawlogs, boom and dimension timber, and all other logs or woods intended for sawing, except spruce, hemlock, cypress and balsam, per standard of 200 feet board measure, ... 26 cents.

Equivalent to $1.30 per thousand feet, board measure.

Spruce, hemlock, cypress and balsam sawlogs, per standard of 200 feet, board measure, ... 13 cents.

Equivalent to 65c. per thousand feet, board measure.

The right to renew the licenses is guaranteed to the 1st of September, 1900, and the tariff of dues and the ground rent is to remain in the same or, at least, is not to be increased up to that date. This is defined by the Orders in Council, dated April 18 and 24, 1888.

In Ontario and at Ottawa, the right to renewal seems unlimited, but no engagements exist as regards any possible changes which may effect the tariff in the future.

By section 6, of Ch. XV. of 51 and 52 Vict., corresponding to article 1341 of the Provincial Consolidated Statutes, the words "merchantable timber" mean "white and red pine, spruce, tamarac, birch, white birch, and ash," to which species the limit holders are now restricted in their operations.

Moreover, by article 33 of the regulations of February, 1888, licentiates are no longer permitted to cut pine trees measuring less than 12 inches nor trees of any other kind measuring less than 9 inches in diameter at the stump.

Besides these precautionary measures, enacted to impede the total destruction of the forests at the hands of the license holders, the Legislature has also provided measures for the prevention of similar disastrous results at the hands of the settlers. Thus by 51 and 52 Vic. Ch. 15, sec. 3-4 (article 1339 Consolidated Statutes), a forest reserve of 20 per cent. is to be made on each lot of 100 acres sold hereafter for actual settlement. And further, in the interest of all, Government, limit holders, and settlers, the law, as far back as 1871, minutely defines the measures to be followed for the prevention of forest fires, and, in connection therewith, all the precautions to be taken in the clearing of land for purposes of settlement.

As the law, in its execution, was left to a great number of persons and not to one especially named for that object, and, in consequence, greatly lacked efficacy, the Province, by an act passed in 1883, and of another to the same effect sanctioned in 1889, (52 Vict.

Ch. 17), has been divided into seven fire districts, and a superintendent placed over each, with power from the Commissioner of Crown Lands to employ the necessary number of men for the suppression of any forest fires, a sum of $5,000.00 is annually set apart by the Government for that service, and the licentiates, who are also interested in the preservation of their locations, are obliged to contribute a similar amount for the expenses incurred in this connection. This contribution, called "fire fee," is collected from the limit holders in proportion of the area held by each.

Lastly, to encourage the planting and cultivation of forest trees, the Legislature has provided, by 45 Vict. Ch. 13, "that whosoever "being the proprietor of and in possession of any land, shall plant "any part of such a land, not less than one acre in extent, with "forest trees, shall be entitled to receive in respect of every acre of "land so planted, a land-order which shall authorize him to pur- "chase to such an amount not exceeding $12.00, any of the public "lands which may be open for sale within the Crown Lands "Agency in which such trees have been planted, or should there "not be such agency, then in the nearest agency subject to the "law respecting Crown Lands."

It is by the same statute that "arbor day" has been established in the Province of Quebec, (see Cons. Stats., Art. 1359 to 1368).

At this point, I think I owe you a word about the "Forestry Reserve Act," now repealed, as I am not certain if the public of this Province ever realized what it meant. It was originally suggested by this Association at the congress at Montreal, in August, 1882, and though popularly deemed a measure hostile to colonization, it was really intended to direct it to the best advantage of the country. The principle at issue, was the reserve, for forest use, of all the lands which were most fit for that object, and to sell for colonization only all that was suitable for that purpose.

To make a selection, detailed and lengthy inspections of each lot were necessary, involving the suspension of sales in certain districts; and this momentary suspension was interpreted as an act of prohibition. Hence complaints and attacks were raised, which brought on the repeal of the law, but I leave it to the thinking public to judge if this measure was not imbued with all sound ideas of provident forethought; even if opposed to preconceived ideas about the grievances of the poor settlers.

To return to the management of our forest domain. For the administration of woods and forests, this Province is divided into

nineteen agencies, and to compass exactly the extent of our principal sources of production, a brief description of the most important of these districts will be found useful.

The "Upper Ottawa," comprises the upper northern valley of that river, extending from Lake Témiscamingue and the due North boundary line between Ontario and Quebec, to the West, as far as the division line of the waters of the Gatineau and Lièvre to the East, from the South on the Ottawa itself, extending to the height of land between the waters of the St. Lawrence and those of Hudson's Bay, to the North.

The "Lower Ottawa" embraces the Northern basin of the same river from that of the Lièvre inclusive to the West, extending to the North-East over the territory drained by the upper waters of the l'Assomption, Lac Quareau and Maskinongé tributaries of the St. Lawrence, and bounded to the North by the summit lands dividing the Ottawa water system from that of the St. Maurice.

The "St. Maurice" agency comprises the entire valley of that river, together with that of the "Du Loup" to the West, and that of the Batiscan to the East; the "St. Charles," the basins of the St. Anne, Jacques Cartier and Montmorency; the "Lake St. John," East and West, the territory watered by the Saguenay and the whole of its tributaries.

"The Saguenay Agency" comprises all that part of the Northern basin of the river and gulf of St. Lawrence from the Saguenay to Anse au Blanc Sablon, at the Eastern extremity of the Province. The others, of much less importance, are the "Gaspé," East and West, "Bonaventure," East and West, "Rimouski," East and West, "Grandville," "Montmagny," Beauce, "Arthabaska," "St. Francis" and "Magog."

The stumpage to be paid is ascertained as follows: As soon as winter sets in and lumbering operations are fully opened, the various forest rangers appointed in each agency, directed by the Superintendent, follow closely the cut effected in each shanty and also by the jobbers. They keep record of all they count and measure and revise the entries made by the cullers of the data which they could not otherwise gather. Their records, with those of the cullers, are all sworn to and are finally examined by the Superintendents, who has a direct control over all the movements of the rangers.

There are six Superintending officers for the whole Province, appointed for the proper execution of the present system of levying duty.

At first, the stumpage was imposed per log, classified according to a certain diameter; but now, as in Ontario and elsewhere, the logs or pieces are taxed on their actual contents reduced to board measure, a system more equitable and effectual, but also more costly, requiring closer surveillance, and a greater number of rangers to effect it.

Formerly the returns prepared by the operators' and rangers' report were examined by the Crown Timber Agents, under whom the lumbering was performed, but now the statements are addressed directly to the Department, where they are confronted with the books kept by the wood rangers, revised by the Superintendents. The accounts compiled therefrom are then sent to the producer and the local agents for collection.

The duty on square timber, which is generally all manufactured for the English market and floated to Quebec for shipment, is collected here by a special officer (who acts also for the Province of Ontario) on the specifications as to the contents furnished by the cullers' office of the Dominion Government.

When I entered the service, I was frequently told that at the rate of cutting followed, in 20 years there would be no more merchantable pine logs in the Province. The 20 years have elapsed and more, and the number and amount produced is greater than ever it was, and each year I find that larger quantities of pine timber are brought down and derived from limits that had already been pretty thoroughly worked forty or fifty years ago.

The total area of Government lands still vacant and not yet under timber license, as well as can be ascertained—our Northern boundary line being assumed to be at the height of land (a line which is extremely irregular and geodetically determined at a few points only)—is certainly not less than 75,000,000 acres, of which 40,000,000 may be deducted as destitute of timber, leaving 35,000,000 acres still untouched.

Out of that last named superficies, 3 to 4,000,000 may be safely laid down as pine-growing, the rest is chiefly covered with spruce, cedar, tamarac, white birch, cypress, birch, and maple. Those species, in the order where they each predominate, may be distributed as follows: The pine in the Lower Ottawa and the St. Maurice agencies, but principally in the Upper Ottawa Valley.

With respect thereto, to indicate the rapid increase in price which this valuable wood takes yearly, I may state that, at the last auction sale, held in January last, limits situate in the most remote and inaccessible section of the last named region, fetched the highest bonus ever obtained at any such public sale held before in the Province.

Excellent spruce, and in quantity, is to be found in the St. Maurice, Saguenay, Lake St. John, Bonaventure, Rimouski and Grandville agencies, as well as tamarac and cedar, the latter being particularly good and abundant in the three last named localities. Tamarac is spread evenly all through the divisions just mentioned. White birch is disseminated everywhere, but is especially plentiful in the St. Maurice Valley, and the Saguenay and Rimouski regions. Cypress and scrub pine, (Banksian pine), in the Saguenay region.

From surveyors' reports, this timber, which is well adapted for railways ties, covers the immense tracts of land watered by the Peribonka, Bersimis, Aux Outardes, and Manicouagan rivers and tributaries.

Then, beyond this Northern height of land, expands the vast wilderness that we now claim in part, and which, at an early date, will certainly fall within our frontiers. Although not all wooded, it contains large extents of timber-growing lands which, some day, will become within easy reach and then fully worth seeking after.

From the little I have said, we can, I think, soundly judge of the magnitude of our forest resources which may surely be set amongst the richest of this continent. They form the main item of our Provincial local revenue ; their existence, as a climatic influence, assures the fertility of our grain growing plains of the borders of the St. Lawrence ; their exploitation furnishes employment and living to thousands and thousands of persons of all classes ; they afford a rich market to our farmers, and moreover they comprise the bulk of our export, nine-tenths of the ships who frequent our harbors going back to all the countries of the world, laden with their produce.

In a financial point of view, the timber trade and the industries depending therefrom have greatly helped to make Canada, and they sustain Quebec. Without them, both would be reduced, at least for a time, to a state of comparative insignificance. This element, in our political economy as a nation, is of immense importance.

It is true that, to a certain degree, we may feel assured of a similar constant supply for the future as in the past, counting upon the physical construction of the upper Valley of all the Northern tributaries of the St. Lawrence, which makes of the greater part of our territory a natural forest region, and that the rigorous climate which pervades over those elevated plateaux render them in many places unfit for anything else, as they will not admit of extensive permanent self-supporting settlements.

It is, however, also undeniable that remarkable legislative and administrative measures have been and are constantly put into requisition for the preservation of our timber wealth; but there remains still something to be done, especially at a time when railway lines are being projected, constructed, and worked through the very centre of these formerly inaccessible regions; creating thereby new facilities for the working out of the tree products and also new factors of intended and accidental destruction. Certainly the subject is one which deserves our best thought and reflection.

ROCKY MOUNTAIN FORESTS.

EDGAR T. ENSIGN, FOREST COMMISSIONER OF COLORADO.

It is hardly necessary to say that the mountains are the most prominent physical characteristic of the Rocky Mountain region; and one cannot observe these attentively without noting the presence or absence of their natural covering, the forests. Again, in connection with the forests, it is difficult to overlook the intimate relation existing between them and the streams flowing from their midst.

Location and Area. The forests of this region, mainly coniferous, are usually situated upon the mountain slopes, at altitudes varying from 4,500 to 12,000 feet above the sea; in some cases at 12,500 feet.

The forest areas, though large in themselves, are not so if compared with the area of the entire region, nor are they to a considerable degree contiguous. There are, at present, no means of determining accurately their bounds and extent. Approximate estimates only can be given, based mainly upon statements re-

ceived from residents in, or persons having special knowledge of, particular portions of the region. According to the best data obtainable, and including in the estimate all kinds of forest growth, light and heavy, valuable and inferior, the approximate forest areas, in square miles, of the several divisions are as follows :— Idaho, 15,990 ; Montana, 26,285 ; Wyoming, 12,060 ; Utah, 6,000 ; Colorado, 16,625 ; New Mexico, 12,500 ; Arizona, 10,300 ; the total being in round numbers 100,000 square miles, or 13.2 per cent. of the total land area. It will be seen that Montana has the largest forest area, and Utah the smallest. The bulk of this forest land is still owned by the Federal Government.

Forests and Irrigation. The direct connection between western forests and the agriculture of the region is evident. The mountain forests nourish and protect the streams, and the streams are vitally necessary to the maintenance of the vast irrigation systems already established or in progress. In each of the Rocky Mountain States and Territories the largest and most important agricultural operations are conducted by irrigation. If it be true of any region that "the forest waters the farm," it is doubly true of that under consideration. It is estimated that the area here already covered by irrigating canals exceeds 6,000,000 acres.

Forest conditions. Upon the mountain ranges are irregular masses of coniferous forests, separated by wide spaces—the latter treeless, or sometimes clothed with a growth of aspen, stunted conifers, or shrubs. Bordering the streams are cottonwood, willow, alder, and other deciduous growths of minor importance. Scrub-oak and cedar, sage-brush and other shrubs—in rare cases a scattering growth of timber—are found on the foot-hills, mesas and plateaus.

This region, though nearly surrounded by arid or semi-arid plains, and subject, more or less, to conditions of aridity, heat and cold, inimical to forest growth, receives in many parts a comparatively large precipitation of moisture, and has abundant sunshine through a large portion of the year. To these last named causes the relatively extensive forests are due, and but for the scourge of fire these would probably be at least one-third greater in extent. Upon the western slopes of the mountains the annual fall of rain and snow is greater than on the eastern ; hence the larger and more important forests are found there. Furthermore, the forests of that region have suffered less from fire and depredation than elsewhere. In all parts of the mountain country, northern ex-

posures are the most favorable to forest growth, as affording maximum conditions of moisture and a minimum degree of evaporation.

Among the most noted Rocky Mountain conifers are the White Fir (*Abies concolor*), the Silver Spruce (*Picea pungens*) and the Creeping Juniper (*Juniperus procumbens*).

Destructive Agencies. Where the mountain sides have been stripped of forest covering, violent storms of rain and wind have had a powerful and disastrous effect. The light surface mould has been blown away or carried downward to the valleys, and this has often been followed by masses of sand and gravel. Where once stood noble forests, are barren, irreclaimable waste, seamed and furrowed by torrents.

The demands of settlement, mining, lumber manufacture, railway construction, charcoal burning, etc., are making heavy draughts upon the western forests. All of these, however, might be met without serious or irreparable injury, were it not for the scourge of fire. It is safe to say that this agency—in the region named, is more destructive than all others combined. The evil will not be abated until wise laws and an enlightened public sentiment shall secure proper and effective forest administration.

Conservative Agencies. The reforesting of the denuded timberland of this region is extremely difficult, and in some localities practically impossible. Nature does much in suoh cases, however, and though the original species may not be reproduced, an inferior growth often appears. The extent of natural reforestation varies greatly in different sections. In New Mexico and Arizona, where greater degrees of heat and aridity prevail than farther north, the second growth is proportionately less in extent and vigor. Where fierce forest fires have scorched the ground and destroyed the vegetable mould, the difficulty of reforestation is greatly enhanced.

What has been said herein concerning reforestation relates to spontaneous growth only. While the necessity is great for reforesting the denuded slopes, the expediency of attempting here the artificial planting of large tracts is doubtful. If men will cease their destructive operations, and extend a protective hand over the forest regions, nature will repair in a measure the injuries of the past. In truth, most kindly healing processes are already begun. The ubiquitous aspen, with its light summer foliage and brilliant autumn hues, gives grateful shade and moisture to wide areas which otherwise would be barren and desolate. The dwarf maple, creeping juniper, wild rose and other hardy shrubs are also helpful

in the restoration of denuded surfaces. In the midst of these minor growths, the seeds of the pine, spruce and other timber trees gain lodgment and find necessary protection.

Although the forests of the region are suffering loss and depletion from many causes, there is reason to hope they may be saved from total destruction. Among the agencies tending to their conservation may be named the partial protection afforded them by the federal and local governments, the work of the American Forestry Association and a few State forestry associations, and the influence and teaching of the public press, which, in its collective capacity, advocates forest reform.

To the Commissioner of the General Land Office, under the Secretary of the Interior, is entrusted the care of the timber as well as other public lands, but with insufficient means to protect the public forests, which suffer accordingly. In the Department of Agriculture there is a Forestry Division, the fuuctions of which, however, are almost wholly advisory. Its work, within the prescribed limits, is effectively performed, and mnch good has resulted therefrom.

The Colorado forest law, which was enacted five years ago, creates the office of State Forest Commissioner, and constitutes the County Commissioners and road overseers, throughout the State, forest officers in their respective localities. It is the duty of these officers to protect from fire and depredation, so far as possible, the public forests, and to promote by all legitimate means, the planting of forest trees. In as much as the State authorities have no direct control of the public timber lands, their duties are more largely advisory and educational than administrative. In the prevention of forest fires and depredation they co-operate with and assist to some extent the federal officers.

Forest tree planting, which, under existing laws, is confined to individual enterprise, though beneficial to the extent practiced, is unlikely to make good the deficiencies caused by forest destruction. In fact, groves and plantations of trees on the lowlands, however extensive, cannot perform the office of forests in the mountains.

Arbor Day has legal recognition in Colorado, and its observance there and elsewhere has an excellent effect.

The manifold uses and varied products of our forests, and their relations to climate, streams, and irrigation need to be more fully realized, so that their wasteful use and wanton destruction may be stopped. Let us hope for the coming of a better day.

FOREST ADMINISTRATION IN FRANCE.

H. L. DE VILMORIN, PARIS.

In France, the administration of forests forms a part of the Department of Agriculture, after having long been connected with the department of Finance.

It consists of a General Director who resides at Paris, of "*Conservateurs*," each of whom takes care of one of the great forest districts into which the whole country is divided, and of "*Inspecteurs*" who fill the local posts under the Conservateurs. "*Gardes-généraux*" are the younger officers of the organization, and have head-keepers and ordinary keepers under them.

The special forestry school is at Nancy, and its reputation such that many young men are sent there by foreign governments for instruction. The course of studies comprises not only geology, botany and natural history in all its branches, but also meteorology, engineering, political economy and administrative law. The pupils are admitted after a competitive examination, unless they have gone through the complete course at the Institut Agricole, our highest agricultural college.

The duties of officers in the forestry service are many and important.

1. They have to look to the preservation of State forests proper, to protect them from damage, and from encroachment by individuals or communities.

Our national forests, are mostly part of the former royal domains, but some, till their confiscation at the first revolution, belonged to "*émigrés*" or the great religious communities, who were often more experienced and able land-owners than the men of to-day.

2. The officers must decide how each section of the woods entrusted to their care is to be made most profitable. There are two classes; copse or bush wood, and high-stem or standard trees.

Copse wood, mostly used for fire wood, which the comparative scarcity and consequent high price of coals makes with us one of the great necessaries of life, is cut after periods extending from seven to forty years, mostly twenty to twenty-five. The standard trees are felled after 80 to 200 years, either all at once, or by picking out some choice trees every year, or an intermediate system is adopted, by which a few trees are spared on each acre at each

period of cutting, to provide seeds and at the same time some matured timber over the underwood. The officer must apply to each particular section the system likely to provide the largest supply of wood, the largest returns in money, and at the same time ensure the growth of seedlings to take the place of the felled trees.

3. Each separate allotment, when ready for cutting, is put at auction, and the forestry officers regulate the size and number of the allotments, and designate trees to be cut. They have besides to watch the operation of cutting and removing the wood and timber, in order to protect the remaining trees from damage.

The leasing of state forests to sportsmen produces, especially near the great cities, an important revenue. While the yearly income from one acre of forest is on an average not much over two dollars, as much is sometimes given, around Paris, for the shooting lease over the same area ; and the lease-holder is moreover bound to fence in all the parts of the wood which are under three years growth, the forestry officers seeing that all the conditions stipulated in the leases are strictly carried out.

4. The work of filling the gaps in old forests is effected either by sowing in patches or planting in holes or trenches the kinds of trees which it is found advisable to propagate. By those means a change is often gradually effected in the composition of the forest, evergreens being substituted for deciduous species, or vice versa.

5. A fifth series of duties embraces the construction of roads, bridges, sledge-ways or wire cable systems of transport over deep chasms or torrents. There exist still in France some mountain sides covered with splendid old fir trees, which cannot be used for lack of means of carrying them either on land, by water, or through the air.

6. Another duty of the forestry officers is to control the management of timber lands owned by communities, especially in the mountainous districts. Such lands are under the "*régime forestier*," that is, under the authority of the national forestry officers, to avoid the destruction of woodlands through reckless cutting, and the damage to young growth by injudicious grazing.

The services so rendered are all the more important as the wanton destruction of forest in hilly, and especially in mountainous districts, often causes floods, accompanied by great loss of property and life.

The effect of stripping the heights of their natural coat of forest

is felt not only on the distribution, but also on the amount of rainfall. Some districts in my country, which were quite fertile and flourishing during the Middle Ages, have become quite barren and burnt up, and the cause of the change has been clearly traced to the destruction of forests on the surrounding heights. Such destruction mainly took place during modern wars, or at the time of the great revolution.

It has been one of the principal endeavors of the recent governments in France to re-establish forests where they had existed in former times, and especially where their influence could be most beneficial in making the rainfall and the flow of the rivers more regular. The results achieved are already comparatively large, and great credit is due to the central administration for its energy and perseverance in prosecuting this work in the teeth of numberless difficulties, political and material.

Men must sometimes be benefitted against their will, and an instance of this is found in the opposition offered by some of the communities on whose territory the work of planting new woods is carried on. The material difficulties are not less. Often the bare rock is exposed, the soil having been washed away, and then the work can be commenced only on slopes and on the banks of torrents. Stakes are driven among the stones, and willow twigs and branches are interwoven so as to form a sort of fence, which stops the earth and loose stones, on which, after a time, fir, pine or larch trees are planted; and slowly, but not always surely, the extent of the new plantation increases, and finally the torrent is turned into a gentle stream, while the overhanging slopes gradually become more or less densely wooded.

Great has been the work in this direction on both banks of the Rhone, on the Provence and Auvergne mountains, in the Pyrenees, and chiefly in the Alps, on the Durance river and on its numerous tributaries, work the benefit of which will be mainly felt by future generations.

A striking instance of the usefulness of the forestry service may be seen in the Landes de Gascogne, where for years the sand, driven by the west wind, kept moving on from the coast in huge sandhills, which buried fields, farms, and even cities. Decisive steps were taken to stop its inland progress about 1825. The engineer, *Brémontier*, protected the surface of the sand hills with branches of the common broom (*Sarothamnus scoparius*) simply pegged in, and under that light shelter he succeeded in germinat-

ing seed of the cluster pine (*Pinus pinaster*). The work of coating the sand hills with vegetation being begun near the beach, the task of establishing woods more inland was comparatively easy, as the outermost belt of pine trees effectually sheltered all the sections in the rear from the high winds and the drifting sands. In this way many thousand acres were covered with the cluster pine, which furnishes valuable timber, besides large quantities of tar and turpentine, so that the Département des Landes, once among the poorest in all France, though one of the most extensive, has become one of more than average wealth.

The forestry service has also promoted the creation of resinous and deciduous woods in the swampy provice of Sologue; and in Algeria has introduced the Eucalyptus and wattle acacias, and developed the cork oak forests. The success of this service is due to its highly scientific organization and the ability of its leading members.

Now would a corresponding, not to say similar organization be likely to prove useful in America? I think so, for many obvious reasons:

1. The demand for wood is likely to increase with the population, if not in the same ratio. The use of iron and steel will not reduce the consumption of wood any more than the establishment of railroads interfered with the demand for wagon or cart horses.

2. The natural forests are certainly being reduced in number and in extent. Otherwise it would not pay to cut hickory stumps left at a first clearing, as I understand was recently the case.

3. Whether the object in view is simply the preservation of existing forests or embraces the creation of new woodlands in such localities as can pay better in wood than under the plough, it would be of paramount importance to entrust the control of the whole work to an eminently scientific body, as no guess-work should be allowed in a matter of such deep interest, where the selection of trees for each place should be guided by a perfect knowledge of the geological, climatic and economic circumstances of the district.

There can be no reason why America, which has done such admirable work in the promotion of scientific farming during the last decade, should not exercise the same judgment and the same enterprise in establishing scientific forestry.

TREE PLANTING ON THE PRAIRIES.

HON. H. G. JOLY DE LOTBINIÈRE, QUEBEC.

The settler on the prairie finds the ground free of trees and ready for the plough, but if he understands his true interests he will devote to the planting of trees some of the time which in the East he would have had to spend in uprooting them. He must not only plant trees for lumber and fuel, or for the beauty which will remind him of the home of his childhood: the trees will also protect his fields against those winds that suck up the dampness out of the soil, and will contribute to prevent the drought so frequent in the prairies.

Belts of trees on the prairies, across the line of the prevailing winds, would greatly tend to diminish the violence of the blizzards. But I do not assert that thickly planted around growing crops they would reduce the danger of night frosts. There is considerable doubt on that point, they may even possibly increase that danger, as stated in a recent letter by Mr. George S. M'Tavish, for many years a chief officer of the Hudson Bay Company.

What trees are we to plant on the prairies? How are they to be planted and cared for? There is much to learn on those points, and the sooner we learn the better.

The Dominion Government and the Canadian Pacific Railway are now making experiments which will prove of much value. I am indebted to Mr. Shaughnessy, Vice President of the C. P. R., for the following information which he has just sent by telegraph:

"Experiments in forestry have been conducted for two years past at twenty-five points along the line of the C. P. R. The most important of these are at Moose Jaw, Swift Current, Gull Lake, Crane Lake, Maple Creek, Medicine Hat, Bowell and Langdon, covering a distance of over four hundred miles. The following trees have succeeded best at these points: Box Elder, American Elm, White Ash, Green Ash, Norway Maple, American Mountain Ash, European White Birch, Yellow Birch, native Poplars and Willows, Scotch Pine and Spruce trees from the foothills of the Rocky Mountains. By the free use of these trees shelter belts and ornamental clumps can be planted successfully on most parts of the great plains."

Both the United States and the Canadian Government have attempted to encourage the planting of trees on the prairies by grants of land, but this plan has not proved successful.

Trees are found on the prairies in the immediate vicinity of the streams, which shows that the soil is not unfit to grow trees wherever there is sufficient moisture. I may be allowed here to quote from Colonel Ensign's report of 1887–'88, the opinion of an experienced agriculturist, who shows that trees can be grown in arid and semi-arid districts without irrigation:

"A correspondent who has a timber-culture claim on government land in the eastern part of the State, asks: Can timber be grown here without irrigation?

"We answer, it certainly can. But we must reverse the system of eastern tree culture. There our trouble existed in the excess of surface moisture, requiring drainage from the trees. In preparing for tree planting the land was deeply plowed, thrown up into narrow headlands and the trees planted on the highest part, so the surface water would drain from the trees into the middle, a 'dead furrow,' and be carried from the field.

"Here we must adopt a system of surface drainage to the trees.

"This is done by planting in the 'dead furrow' instead of on the headland. By reversing this order of planting, trees not only receive the benefit of the rain-fall, but the snows drift into this 'dead furrow,' protecting the trees through the winter, and thoroughly soaking the ground when melting in the spring. In addition all manner of decaying vegetables drift and collect in this low ground, forming a valuable mulch to retain moisture."

However that may be, it is evident that we have a great deal to learn from experience before tree planting can be carried on successfully on the prairies. The expense of experimental stations conducted on scientific principles may be great, but it has become necessary. In the meantime we can acquire a great deal of useful practical experience with a relatively small expenditure. Scattered over the western prairies of the Union there are a number of military stations, and over the prairies of Canada many posts are occupied by the mounted police. Why not employ the men in planting trees at these stations? Many among them would soon take a pride in the trees planted with their own hands, and pleasure in beautifying the wilderness in which their lot is cast. Nothing is cheaper than starting a nursery from seed, especially when the labor can be procured as cheaply as in this case. The men

might be provided at a small expense with any quantity of seed and a few tools; they might be shown how to start the trees and cultivate them, and those who did the work would have the privilege of selling them to the settlers. There is a general demand for young trees for planting all over the northwest.

I am convinced that if some officer in the prairie stations would set the example, he would find among his men more than one who would be glad to help for the sake of relieving the monotony of their existence and for the profit it might bring them. Let them start their plantations, watch the growth of their young trees and tend them carefully; they will become an object of ever growing interest for them, and make their lonely life happier and better.

SYSTEMATIC TIMBER-CUTTING IN QUEBEC.

J. X. Perrault, Secretary of the Quebec Forestry Association.

Now, while the destruction of the state forests is carried on so systematically that it is possible to foretell the fatal moment when the province of Quebec will be stripped of its most valuable forest-trees, it is a public duty to make a last appeal to the patriotism of the men who govern us to put an end to the vandalism of which we are every day the witnesses.

For more than a century the public domain has been pillaged with the thoughtless consent of the state. What was once the finest forest-property in the world has been ruined by pasturage, and by the wasteful methods of lumbermen who, not content to make enormous fortunes at the expense of the Province, have cut and destroyed everything in their path without thought of the future.

Our neighbors in the United States have acted with the same want of forethought, but with this difference, that with a population ten times larger than ours the destruction of their forests has gone on more rapidly. Never, perhaps, in the history of any people has there been seen the administration of a public domain so criminal and so disastrous. The forests of the United States, from

the Atlantic to the Pacific and from the frontiers of Mexico to those of Canada, cover 450,000,000 acres. The annual cutting over of 25,000,000 acres gives on an average 4,800,000,000 cubic feet, of lumber. The railroads use, in addition, 500,000,000 feet, the mines 150,000,000, fences consume 500,000,000; 150,000,000 feet are exported, while 18,000,000,000 feet are consumed as fuel. The whole forms the enormous total of 24,000,000,000 feet, of an approximate value of $1,000,000,000—that is to say, more than the total value of the crop of wheat, rye, oats, potatoes, cotton and tobacco produced in the United States, and thirty-three per cent. more than the value of all exportations of every kind from that great country.

It is hardly conceivable and yet it is true, that no forest-administration has been charged with securing intelligent management of this colossal property. It has been truly said that the real riches of a country are not in its deposits of the precious metals, but in its forests, and yet, thanks to the folly of the Government of the United States, these fruitful sources of public wealth have been allowed to perish without any thought beyond the morrow.

Some idea of the enormous traffic which springs from the forests of the United States may be gathered, perhaps, from the fact that in Chicago alone the 2,000,000,000 feet of wood and lumber which are handled in that market represent 1,000 car-loads for every working day in the year. If all the forest-products of the United States were moved by rail, we should have a train equal in length to eleven times the circle of the globe at the point of its greatest diameter. The northern states alone produce two-thirds of this lumber each year, or about 20,000,000,000 feet, worth three hundred millions of dollars. This represents a weight of 500,000,000 tons, and would require a fleet of 500,000 vessels, each of 1,000 tons burden, to transport it—that is, a tonnage equal to twice the fleets of the entire world.

This forest-wealth of the United States has been so used and abused that already the richest forests have disappeared. The pines of Michigan, Wisconsin and Minnesota, once considered inexhaustible, exist no longer. They have been exterminated; and this is readily understood when it is remembered that a single mill in this region has cut half a million feet a day, and that the capacity of all the mills of the United States is more than 60,000,000,000 feet a year. According to the Census report, there were in 1880, 55,175,000,000 feet of pine standing. Since that time

45,475,000,000 have been cut, so that in all the northern part of the United States there is now only two years' supply of white pine of the best quality left, with more or less pine of inferior quality. The improvidence of the Government, and the insatiate desire to grow rich rapidly, have brought our neighbors' forests into this condition. It seems almost incomprehensible that a nation so intelligent and practical can allow itself to be despoiled of one of the principal sources of national wealth while it was so easy to render it perpetually productive.

And what have we done ourselves here in Canada? Have we not committed the same blunders? Has not our public domain been pillaged also? How many millions have been sent from Canada during the last fifty years to enrich the people of London? Our pine-forests have nearly disappeared. The timber of which we were once so proud has vanished. The pine, which is now found only between the Red River at the west and Migen at the east, does not extend north of the forty-ninth degree of latitude in the valley of the Ottawa, and the fifty-second degree in the region of Albany Lake. There is none north of Lake Superior. Our best pine-forests were in the valleys of the Ottawa, of the San Maurice, of the Saguenay and their tributaries. All these have been destroyed, and now it is necessary to go 300 miles from Ottawa to the head-waters of the San Maurice and to Lake St. John to find lumbermen at work. All that immense forest-territory of the province of Quebec, of more than 100,000 square miles area, would represent to-day hundreds of millions if the state had managed it intelligently. But here, as in the United States, every one supposed our forests were inexhaustible. They have been cut without pity and without rest.

The Government was deaf to every appeal to protect the public forests as long as a few hundred thousand dollars, derived from the forest, was available to make up the deficit of the general administration. The sale of limits made often to political partisans, most often fraudulently and at prices absolutely ridiculous, have almost entirely ruined our forests. Great bodies of timber have been sacrificed at ridiculous prices in time of panic when there was no demand for timber. In 1844 the Government, among other limits, sold one of 100 square miles for $4 a square mile—that is to say, at the rate of two acres for one cent. Is it possible to imagine any greater folly in the administration of Government affairs? The results of these wasteful methods are apparent. The cut of pine east of Montreal, which amounted two years ago to 250,000,-

000 feet, has now fallen to 25,000,000—that is to say, to an annual output of only ten per cent. of the former production—and this for the excellent reason that there is no more pine to cut in that region. It is the price of the ruin of the forest-capital of the province which the government of Quebec has received and still receives every year. We have obtained as a gift from our fathers a forest-domain unequaled in the world. It was able every year to produce an enormous revenue, sufficient, if properly administered, to meet all the expenses of the state. And we have not been sufficiently intelligent to administer this property in such a way as to perpetuate the revenue for our children. On the contrary, without regard to the most elementary rules of forest culture, we have alienated the forest-domain by throwing it open to a crowd of greedy speculators whose only aim has been to destroy it entirely. Such criminal conduct merits the contempt and reproof of the whole world. The province of Quebec is not alone culpable. Ontario, New Brunswick, Newfoundland are even worse off than we are, and when the fotest-resources of the Canadian confederation are examined, it is only too apparent that in a comparatively short time we shall be obliged to depend for our timber upon other provinces. British Columbia, on the Pacific side of the continent, is well wooded, but her forests are too remote to be of practical value to us here in the east. The timber supply of British Columbia will be needed by her own people and by those of the north-west. Her timber can be sent to Australia, California and South America more advantageously than to us here. From the Rocky Mountains to Lake Superior timber is scarce. It is disappearing rapidly in Ontario ; and in the maritime provinces and in all the eastern counties consumption is increasing and the supply is disappearing very rapidly.

It is evident, then, that the province of Quebec must adopt at once the methods which are everywhere recognized as necessary to stop this destruction and assure by means of an intelligent administration the perpetuity of what remains of our forest-domain. It is necessary, in a word, to inaugurate here a system of regular cutting such as is practiced in France, Germany and other civilized countries, where not only the annual output is preserved, but the extent and value of the forests are steadily increased. The government of Quebec should, in order to preserve its forest-domain and increase for all time its productive capacity, adopt the following plan :

First. It should divide the public domain into five great forest-

regions—namely, Ottawa, San Maurice, Saguenay, the counties of the east and Gaspé—and place each under the direction of a general forest-officer. Each of these forest-officers should then divide his region into as many forests as there are distinct regions, each composing a certain number of limits.

Each forest should be worked, under the direction of a forest-officer of the region, by a timber-merchant, owner of a saw-mill, and such a forest should be cut once in every twenty years or more, according to the nature of the soil and the trees which are found in it. In this way every year a twentieth part only of the forest would be worked; the remaining ninety-five per cent. should be left to its natural growth and protected against all inroads from the lumberman or his employees. By only cutting each year trees which have arrived at their full value, those preserved would be ready for the axe twenty years after. In this way a forest will perpetuate itself indefinitely, yielding constantly an equal and regular annual product without deterioration.

Second. Every year the Government should determine what will be the amount of timber called for by the needs of commerce in order to avoid the over-stocking of the market and the commercial disasters which result from over-production and the consequent shrinking in value of forest-products.

Third. As is well known, the squaring of timber in the woods, by which the soil is covered with chips, is an imminent cause of fire, and a third of the wood moreover is lost by this means. The Government should demand that all trees should be sawed, not hewn, or floated down the streams in convenient lengths to points of shipment.

Fourth; The Government should exercise an intelligent inspection over the operations of lumbermen, and it should be the duty of the general forest-guards of each region to mark themselves, or to have marked by their assistants, all trees to be cut or to be reserved in the annual cutting.

Fifth. The Government should send to the Forest-School at Nancy a certain number of young men who, having followed the course there in forest-studies, would be fitted later to assume the direction of our woods and forests.

Sixth. As the management of our woods and forests belongs to the department of the Minister of Agriculture, the general forest-guards should be placed under the direction of that officer in all matters relating to the valuation and exploitation of the forest-domain.

It will, perhaps, be argued that these indispensable forms will entail serious expenses on the Government. This is a mistake. It is simply a redistribution of duties and a transfer of the Government employees, which is necessary in order to put this system in operation. And after all, a forest-domain of 50,000 square miles is well worth the trouble and expense of some attention. It produces annually something like 400,000,000 feet of pine and 110,000,000 feet of spruce, besides 37,000,000 feet of red and white pine timber, 600,000 feet of hard wood, 4,500,000 railway ties, besides vast quantities of cedar, tamarack and 5,000,000 feet of fire-wood; the whole producing a revenue to the provine of a million dollars. The total annual forest-product for all Canada amounts to $25,000,000, and this will double certainly as wood becomes rarer in the United States. In a few years from now the province of Quebec will obtain from her forests a revenue sufficient nearly to meet all her expenses, provided an intelligent forest-administration can be established. We still have in our forests and in our waste land hundreds of millions of dollars with which can be assured the greatest prosperity of the province, but it is necessary that the men who govern us should realize the urgent necessity of administering wisely this magnificent inheritence upon which depends the future prosperity of the nation. And especially is it necessary that they consider the rights of the coming generation and determine to protect this inheritance against the attacks of the short-sighted and thoughtless.

EFFECT OF FOREST-MISMANAGEMENT ON ORCHARDS.

B. E. Fernow, Chief of the U. S. Forestry Division, Washington, D. C.

I do not intend here to rehearse the influence which the forest exerts upon fruit culture by reason of its protection against cold and hot winds. The value of a properly disposed shelter-belt for the orchard is well understood. It was by opening up the country to the sweep of the northern winds that the cultivation of the olive in northern France was made impossible, and other such re-

sults of injudicious deforestation of local as well as general character, are on record. I wish now to show that not deforestation, but the mere mismanagement of the forest in the way of leaving large parts of felled trees in the woods and in allowing fires to run through the woods, works injury not only to the forest itself, but to the neighboring orchard. It is well known that a large proportion of the beetle larvæ which infest living trees cannot exist in a thoroughly healthy and vigorously growing tree; those larvæ in particular which are found in the cambium layer between the wood and the bark would be drowned in the sap of healthy trees. They are, therefore, mostly found in those trees which, for some reason or other, are less vigorous or on the road to decay. When a fire has run through a pine forest, or when a leaf-destroying caterpillar has ravaged the foliage and thus reduced the vigor of the trees, these beetles find a most favorable breeding place in the weakened trees, and their larvæ multiply rapidly and finish the work of destruction in a short time. For this reason it is often necessary to cut millions of feet of lumber and cordwood at once, or it will be entirely ruined. While, then, these little insects, belonging to the families Bostrichidæ and Scolytidæ, are great enemies to the forest itself, there is no doubt that many of the insects injurious to our fruit and shade trees find their most favorable breeding place in the trunks and limbs of the scorched or freshly felled trees. The frequent forest fires and the failure of the farmer and lumberman in disposing of large parts of the felled trees must be considered as among the principal causes of the prevalence in North America of these insect borers. The horticulturist may destroy the borers in his orchard or vineyard, but the mismanaged and maltreated forest makes a fertile breeding ground for them and replaces those destroyed by the watchful orchardist.

To substantiate the assertion, the following examples may be cited:

One of the most dangerous enemies of the orchard, the Flat-headed borer (*Chrysobothris femorata*), is found to breed in enormous numbers within the trunks of various forest trees that have been injured by fire.

The Oak-pruner (*Elaphidium parallelum*), which does considerable injury to apple trees, is found under the bark and in the wood of oak, hickory, elm and other forest trees that have been recently felled and left in the woods, or that have been reduced in vigor by fires.

Several other species of the same family, among which are *Prionus laticollis*, the broad-necked Grape-root borer and others, often injurious to the roots of the grape vine, breed in the trunks and stumps of forest trees, especially oak. *Pelidnota punctata*, a large Scarabæid beetle, which destroys the foliage of the grape vine, comes from the same breeding place.

One of the dangerous enemies to cultivated blackberry bushes, *Agrilus ruficollis*, the red-necked blackberry borer, preferably breeds and multiplies in the wild blackberry and raspberry bushes that have been scorched by fires. *Amphicerus bicaudatus*, the apple-twig borer, very injurious to apple and other orchard trees by boring in the twigs, breeds in the roots of the *Smilax* vines which have been killed by fire.

The various species of bark-borers of the Scolytus family, which attack orchard and shade trees, could be readily kept in check, but for the fact that they breed unmolested and multiply in fallen forest trees. Such are the Pear-borer, *Xyleborus Pyri;* the Pear-blight Scolytus, *Phlaeotribus liminaris*, and the Apple Tomicus, *Monarthrum Mali*. This list of injurious insects, which find most favorable conditions for development in the mismanaged forest and threaten the orchard, vineyard, park and plantation, could no doubt be largely extended.

It would be difficult to tell what in amount the loss from these borers may be. We have learned that insect ravages entail the loss of millions. Thus the loss from the Cotton worm was estimated in one year at almost $30,000,000. And when we consider that the tree-borer does not destroy the year's crop only, but the crop-bearing tree itself, the accumulation of many year's growth and all the labor spent on it, we may readily see that, in proportion to the extent of orchards and vineyards, the loss must be considerable.

We have here another illustration that all things in nature have their relation, and that if we interfere with their adjustment we are sure to throw them out of balance and suffer accordingly. We have another lesson which teaches that cultural and forest conditions are closely related to each other, and that, as we disregard proper forest management in utilizing nature's gifts, we must bear the consequences in other directions.

FORESTRY AT THE DOMINION EXPERIMENTAL FARMS.

The Experimental Farm System has only been in operation a little more than three years, including the work of organization. The Farms are five in number, at Nappan, N. S., the central one at Ottawa (whence the Reports of the others are disseminated in the same manner as those of the Agricultural Experimental Stations of the United States), at Brandon, Man., at Indian Head, N. W. T., and at Agassiz, B. C. Brandon and Indian Head have each a section of land; Agassiz and Nappan each three hundred acres; while the Ottawa farm, serving for Ontario and Quebec, has four hundred and sixty-seven acres.

The central farm began its operations in the spring of 1887; Nappan, Brandon and Indian Head following in 1888; while Agassiz was not organized till 1889.

With such an expanse of territory, the needs are exceedingly varied, and therefore the range of useful knowledge to be obtained is much widened. So far it has been the aim of the management of the central farm to supply such trees as are in the judgment of competent men best suited to the conditions of soil and climate at these different points. Reliable reports from the superintendents of the branch farms will facilitate the speedy introduction of suitable trees to the different portions of the Dominion, *especially* to the wind-swept prairie regions of Manitoba and the northwest.

One of the permanent features in forestry on the farm at Ottawa is the planting of a belt of trees on the north and west sides, made up of different varieties grouped in blocks for comparison. Many of these clumps are planted in irregular forms, so arranged as to overlap each other, which overcomes the stiff appearance given by planting in squares. The belt is about one hundred and fifty feet wide; the first ten rows on the west being five feet apart, and the rest ten feet apart each way. This has been done to ascertain the relative advantage of close or wide planting. Careful records of the age at planting, the annual growth thereafter, and other necessary particulars are taken, and will be reported as soon as practicable. There are in this belt about eight thousand trees, made up of the following varieties: conifers; Scotch pine, white pine, Riga pine, Austrian pine, Norway, white and blue spruce, hemlock, arbor vitæ, European and American larch; deciduous trees; red, white and burr oak, sugar maple, soft maple, Norway,

red and Negurdo maple, white, yellow and canoe birch, white elm from Manitoba, native white and red elm (*u. fulva*), Rock elms (*u. racemosa*), black ash (*f. sambucifolia*,) green (*f. viridis*), red (*f. pubescens*), white (*f. Americana*), European ash (*f. excelsior*), black walnut, butternut, European alder, hickory, Lees catalpa, Japan catalpa (*e. Kæmferi*), hardy catalpa (*c. speciosa*), Russian mulberry, yellow locust, honey locust, black cherry, European and American mountain ash, sycamore, beech and horse chestnut.

Thus far it is premature to speak of results, yet failure in some cases is so emphatic as to force conclusions; for instance, the catalpas, speciosa not excepted, appear to be worthless, and will certainly never make timber trees in the vicinity of Ottawa. Russian mulberry, honey locust and American sycamore suffer slightly. Black walnut promises to succeed, and we have trees three years from seed six to seven feet in height. Negurdo maple, Russian mulberry and yellow locust are about equally rapid growers, and lead all others in the belt, though for economic value I think with Prof. Lazenby that there are few trees equal to the white ash.

Besides this belt another is planted with the above varieties and a number of hardy shrubs. Here the varieties are planted in rows to admit of cultivation, but indiscriminately mingled somewhat after forest conditions, and will afford experience from another aspect. One of the initiatory steps at the central farm was to obtain a liberal collection of the seeds of Rocky Mountain and European conifers, and as a product from these seeds we transplanted from seed beds last Spring about 175,000 plants or young seedlings, made up of Riga, Scotch, Austrian, stone and ponderosa, or yellow, pine, Douglas, blue, Norway and white spruce. These will be distributed, when of proper size, to the branch farms and other experimenters, who will give us careful returns. Our stock was also increased by importations of seedling deciduous and coniferous trees from Europe, which are being distributed to those points which seem best adapted to their culture.

In order to encourage tree-growing in the northwest territories, the Minister of Agriculture caused to be distributed free from the central farm to voluntary applicants last spring, 100,000 forest tree seedlings, one hundred trees going to each individual, together with instructions for planting and after-care. It will be seen by this arrangement that provisions were made for one thousand packages. The applications exceeded the supply by fifteen hundred, showing that there was no lack of interest. Each pack-

age was made up in varying quantities of the following varieties: white ash, green ash, box elder, soft maple, hard maple, white elm, honey locust, black locust, black walnut, butternut, Russian mulberry, black cherry, cottonwood, sycamore, linden, Kentucky coffee tree, red cedar and wild olive (*Eleagnus angustifolia*). This distribution covered a very wide territory, and the results cannot fail to be valuable. In addition to this, the C. P. R. gardens, twenty-five in number, situated along the main line west of Winnipeg, have been supplied the past two years by collections of trees from the Ottawa farm, and it is upon these trees that the results as given in the telegram read by Mr. Joly last night are obtained. The Indian and police stations, in the far north and west, have for the past two years received liberal collections of the hardier trees and shrubs from the farm at Ottawa, with such suggestions for their care and culture as their particular locations seemed to demand.

Arrangements are being made to continue the work of distribution on a larger scale the coming year, and it is hoped that this slight inducement will enable and encourage settlers in the colder parts of Canada to select such varieties as are best adapted to their conditions, and assist in establishing a limited culture of fruits in sections now deemed unsuitable.

An important point, very often overlooked by northern planters, is the careful selection of the hardiest forms of each species. This is well illustrated in the difference between the Ohio box elder and that grown at Winnipeg. While the former is not as hardy at Ottawa as catalpa, the latter is one of a few trees that came through uninjured at Indian Head, N. W. T., last winter, some of the others being Manitoba elm, Siberian pea tree (*Caragana arborescus*), and the so-called Russian wild olive (*Eleagnus angustifolia*). The same is true, though in a less marked degree, of the Manitoba ash and elm, as compared with the same botanical species here. While our common form was injured at Indian Head, the native of Manitoba came through in good condition. The black walnut of Minnesota and Dakota, and Kentucky coffee tree of central and northern Iowa, are essentially hardier than their southern relatives, and it should be our aim in this region to obtain seeds from trees at the northern limits of their native habitats.

FORESTRY ON THE WESTERN PLAINS OF CANADA.

By Wm. Saunders, Director of Experimental Farms, Ottawa.

Experiments in tree planting were begun at all five government farms as soon as possible after they were located, but on those in Manitoba and the North-West Territories this work has been conducted on a more extensive scale than elsewhere, as the need of forest shelter is much more keenly felt in the prairie districts. Work was begun on the farm at Indian Head, N. W. T., during the summer of 1887, and the first trees were planted in the spring of 1888, about 20,000 in all, consisting of a large number of varieties. This farm is a section of bare prairie land of 680 acres without any shelter whatever. In the spring of 1889 another consignment of about 12,000 was forwarded, and during the present season a few thousand more have been sent. A considerable quantity of seed of the box elder, with a smaller proportion of white ash and American elm has been sown each season, and thus more than 50,000 seedlings have been added to the stock. A portion of these seedlings have been distributed among the settlers in the neighborhood of the farm, but the larger part has been planted in shelter belts and forest clumps on the farm.

The Brandon, Man., farm was selected during the summer of 1888, and tree planting was begun there in the spring of 1889. About 20,000 trees were sent that year and ten or twelve thousand more in 1890. A large number of seedlings of box elder, ash, and elm have also been grown there during both these seasons. The Brandon farm is situated partly in the valley of the Assiniboine River and partly on the bluffs which form the northern boundary of that valley. This farm is mostly prairie, but in the ravines in the bluffs, and also on the face of the bluffs there are large patches of scrub, consisting of scrub oak, hazel, elæagnus and other low bushes, while near the river bank there is a small grove of elm, ash, and box elder trees, with undergrowth of willow, rose, etc. The land on these two farms is varied as to exposure, while the soil and the climatic conditions by which they are surrounded are such as to involve most of the difficulties which stand in the way of tree growing in the better farming districts in the Canadian Northwest.

During the spring of 1889, many packages of trees were sent to different parts of the Northwest plains for test, and this work has been continued on a larger scale during the past season. The distribution outside of the experimental farms in 1890 consisted of 130,000 seedling trees of one and two years' growth, which were sent by mail in 1300 packages of 100 each to as many different points, while larger bundles were forwarded by express to twenty-five of the experimental gardens on the line of the Canadian Pacific Railway from Moose Jaw to Calgary, to most of the agencies on the Indian Reserves, and the chief stations of the mounted police. By these several methods, trees have been distributed for test over the whole area from the eastern part of Manitoba to the western extremity of the great plains of the Territories and along the foothills of the Rocky Mountains. On the Indian Head farm trees have had the test of two winters and three summers; on the Brandon Farm and at a few other points, including about twenty stations on the Canadian Pacific Railway, we have the results of one winter and two summers; while at a very large number of other points the summer draught and heat is the only test the trees have yet been subject to. This latter, however, is no mean test, for dry weather will often cause the death of more trees than will the cold weather of winter.

The results of the tests on the experimental farms have been carefully noted each year, but the experience gained is too limited as yet to admit of very positive statements regarding many varieties of trees under trial. The following notes may be of some interest.

Box elder, *Negundo aceroides*.—This tree promises to be the most valuable of all forest trees for the Western Plains, adapting itself to all conditions of climate and situation, and making thrifty growth under trying circumstances. No tree is so universally successful, but to get the best results the seedlings should be grown from seed collected from trees growing on the river banks in Manitoba or the Territories. If grown from Eastern seed the young trees are often partly winter-killed. In three or four years from the time of sowing the seed, this tree will usually attain a height of from five to seven feet, with a nice bushy head, and after that the growth is quite rapid.

Among the trees which promise to rank next in value are the American elm and white ash, when grown from Manitoba seed, but these often prove more or less tender when grown from seed

produced in Ontario or the Western States. The native poplars and some of the willows also make fine growth and aid materially in the formation of shelter belts; some of the Russian poplars have also succeeded very well, notably *Populus petrovska*, *certinensis*, *bertolinus* and *bolleana; salix laurifolia* is also valuable. The American and European mountain ash, yellow birch, European white birch, and the variety of white birch, known as the *cut-leaved*, have also proved hardy as far as they have been tried. Of the maples, the only ones which have succeed thus far are the silver-leaved, *Acer dasycarpum*, and the Norway maple, *Acer platanoides*, and these are only partially successful. The Siberian maple, *Acer ginuala*, has proven hardy at the Indian Head Farm, but this will rank rather as a shrub than a tree.

Among the evergreens the white spruce, transplanted from the sandy plains near Carberry, Manitoba, or the spruce from the foothills of the Rocky Mountains, succeed best. The Scotch fir and the European mountain pine are also hardy in many places, enduring the low temperatures of the winter better than the drying winds and hot weather of the summer months. The white spruce of the East, Norway spruce, arbor vitæ, Austrian pine, red cedar and European larches have failed in most localities in the Territories, but many of them have survived and made a little growth in some places in Manitoba. The same may be said of the bass-wood, European ash and Russian mulberry. The attempts to grow the sugar and red maples, sycamore, black locust, butternut, black walnut and Western catalpa have so far been unsuccessful.

Among the most valuable shrubs useful for ornamental purposes and as undergrowth, are the several native willows, the wolf willow, *Elæagnus argentea*, the native wild cherry, *Saskatoni*, and hazel, to which may be added the Siberian pea, *Caragana arborescens*, Russian olive, and the several varieties of lilac. The wild rose also serves a similar purpose, and the *Rosa rugosa* from Japan, which has proved hardy and valuable at Indian Head.

By the free use of the trees and shrubs named, effective shelter belts and forest clumps can in a few years be produced on the Northwest plains, which will help to break the force of the winds and give a home-like beauty to the bare prairie. When sufficient time has elapsed to allow of more extended testing, many valuable additions will do doubt be made to the list now given.

MINNESOTA WOODSMEN.

H. B. AYRES, NORTHERN PACIFIC JUNCTION, MINN.

[NOW OF THE FORESTRY DIV., DEPT. OF AGRICULTURE, WASHINGTON, D. C.]

The forest-region of Minnesota has an area of some 39,000 square miles, extending from the Canadian boundary southward to an indefinite border, from the St. Croix river near Rush City, westward, near Princeton, St. Cloud and Alexandria, to within a few miles of Fergus Falls, thence northward near Red Lake Falls to the forty-ninth parallel.

Logging operations have been continuous in this region for more than thirty years. During the season of 1889-90, 1,174,607,000 feet, board measure, of pine log timber were cut within this area. To cut and bank this timber required the work of 14,780 men, classified as follows: 118 superintendents, 150 cruisers, 354 scalers, 472 foremen, 1888 sawyers, 472 sled tenders, 2,596 teamsters, 3,776 swampers, 1888 chain tenders, 994 road monkeys, 472 landing men, 118 blacksmiths, 118 handy men, 472 cooks, 472 cookees, and 472 stable boys. Add to this number of men employed in logging the low estimate of 5,000 men working on ties, piles, poles, and cordwood, we have an army of at least 20,000 men, finding comfortable quarters and good pay, six months of the year, cutting and hauling crude forest-products to market.

Of these men but one class—synonomously called cruisers, explorers, examiners, inspectors, or woodsmen—need necessarily be woodsmen in the full sense of thoroughly knowing the woods. In designing and planning logging operations, the superintendent, especially if he is putting in any considerable amount of timber, needs assistants who know all about lines, corners, topography, timber, roads, and road making, the driving stream, and clearing it, and have a good general knowledge of every work connected with logging. These examine the tracts to be cut, estimate the amount and quality of timber, map the land, showing location of timber, with general topography, lay out roads, locate buildings and landings, and after cutting has commenced see that everything is properly done; that all the marketable timber is taken, that no worthless logs are hauled, that no timber is wasted in cutting, that the logs are being properly landed and correctly marked, stamped and scaled. Where men of this class are employed by land owners, timbering and logging is but part of their work; for they

are to carefully map the land in detail on a scale usually not less than four inches to the mile, showing all topographical features, especially streams, lakes, marshes, hills, the various species of trees, size, condition and amount of each kind, undergrowth, bush, grass, liability to fire and trespass, cost of clearing, cost and extent of drainage, and the grade of each tract according to its desirability for farming purposes.

The life of these men is one of continuous liability to exposure, hardship, and severe physical labor, and requires, besides the best of physical constitutions, mature and independent judgment, with unusual fidelity and discretion.

At work, these men move in parties of from two to six, carrying tent, cooking utensils and provisions on their backs. In summer, a party of four can carry their complete outfit for three weeks' work. Canoeing along the water courses, where available, is a great convenience, and is hailed with delight by all as a desirable change from the tiresome monotony of packing.

Throughout this region is a great lack of sentiment and caution against starting forest fires. Camp fires so often die out without spreading, or spread unseen by the camper, after he has moved away, that habitual carelessness is the rule even among men considered thoughtful.

FORESTS IN THEIR RELATION TO THE PUBLIC HEALTH.

DR. PETER H. BRYCE, TORONTO, SECRETARY ONTARIO BOARD OF HEALTH.

From the earliest times that the phenomena of climate have been observed, we have abundant evidence that the presence or absence of forests has been remarked as producing influences, which have had their effects upon the salubrity of different localities; and, in the warmer countries of Southern Europe and Asia, the deities of the woods and groves stood in high favor with their devoted worshippers.

The people of more recent centuries, too, have not been blind to the protective influence of forests; but it has, until very recent

years, been difficult for the energetic settlers who have had to hew out for themselves homes from the forest primeval, to view the sturdy forest trees in any other light than that of their natural enemies.

Indeed, it yet seems hard for us, as we visit our frontier settlements and see the small clearances and limited sources of income which the settler possesses, not to sympathise with him in his struggle for existence, and to view with calm indifference the wanton destruction of the woods, which in older settled portions o the continent, are coming to be looked upon with a regard akin to reverence. To most of us the value of our forests, as direct revenue producers, must naturally appeal first, while to many others their indirect value from the influence they exert on agricultural productiveness will appear important; but few, indeed, have carefully considered how far-reaching are the influences which their existence or their non-existence may exert upon the public health. Some few months ago I had the honor to briefly introduce the subject of "The Preservation of our Forests a National Sanitary Need" to the International Conference of State Boards of Health then in session at Nashville, Tenn., at a time when the levees of the Mississippi were in danger, and when in some of the Gulf States, destruction had visited extensive areas of country. The Conference, and notably those delegates from the South-Western States, realizing the importance of the matter, adopted strong resolutions expressing their views and forwarded them to Federal and State authorities, urging the adoption of such legislation as would encourage tree-planting in suitable localities over the continent, and thereby serve to mitigate in some degree that destruction of life and property from floods and cyclones, due in large measure, we believe, to the absence of adequate forests on the head waters of many of our largest rivers, and upon the thousands of miles of prairies popularly spoken of as treeless.

To further show its active interest in the important work of which this meeting is the exponent, the Conference, through its president, has requested me to attend here as its delegate, and lend to those who are engaged in this praiseworthy work the support of our Association, whose members comprise the most active and prominent sanitarians of the various states and provinces on the continent. In the name, therefore, of the International Conference of State Boards, I am present to-day to offer this assembled Congrees greeting, and to offer the active support of this conference

of health officers in all measures tending to the abatement, or, at least, the mitigation of those evils which are unfortunately too apparent to all of us.

Engaged some fourteen years ago in lecturiug on chemistry and meteorology to the students of the Agricultural College of Ontario, I became greatly interested in the influence on organic vegetable life, of the amounts of rainfall during the months of germination and growth; and being anxious to determine, if possible, the truth of the theoretical teachings of chemical physics, as regards the relationships between soils, trees, and the circumambient atmosphere, I made a careful and laborious study of the tables of the Toronto observatory, beginning with 1840, and for purposes of comparison took the semi-decades of 1840-45, 1850-55, 1860-65, 1870-75.

From the tables which were published at the time in a paper read before the Canadian Institute, several results became apparent.

TOTAL SNOW AND RAIN.

1840-44	216.57	inches.
1850-54	164.684	"
1860-64	160.387	"
1870-74	152.62	"

or, between the first and fourth periods there was a total decrease of 63.95 inches, or a yearly difference of 12.79.

The total moisture is divided as follows:

TOTAL RAIN FALL.

1840-44	191.020	inches.
1850-54	137.999	"
1860-64	131.706	"
1870-74	113.150	"

or, between the first and fourth periods there was a total decrease of 77.87 inches, or a yearly difference of 15.35 inches.

TOTAL SNOW FALL (12 inches snow, one inch rain.)

1840-44	322.70	inches.
1850-54	320.10	"
1860-64	344.38	"
1870-74	473.83	"

or, between the first and fourth periods there was a total difference of 151.13 inches, or a yearly increase of 12.59 inches.

These calculations agree exactly with theory. In comparing

the individual quarters of each period, I arrived at the following results: March has remained much the same still; with April is found a decrease of more than ½ inch, a decrease that increases with each month until September, thus:—

	April, May, June,	July, August, September.
1840–44	48.55	68.101
1850–54	40.195	48.625
1860–64	32.742	45.617
1870–74	34.670	35.14

The significance of this unpleasant change must be evident to all. The average temperature of the two months of germination is lower now than it was forty years ago. Thus:—

	March.	April.	May.
1840–44	29.88	42.62	51.22
1850–54	30.24	40.06	50.68
1860–64	29.02	40.80	52.86
1870–74	27.24	40.18	53.36

This undoubted fact causes what is termed a late spring, the period for growth and development of the plant being shorter than formerly. The temperature of May, the first month of real growth, is now warmer than formerly, by an average of nearly two degrees. The growth is thus apparently forced unnaturally to make up for loss in April, but the attempt is rendered futile by an undue dryness, the rainfall in May having been:—

1840–44	15.015	inches
1850–54	13.675	"
1860–64	14.055	"
1870–74	8.640	"

I shall only say here that it is apparent that if the period of germination is made later in Ontario by April becoming colder, and if the month of May is notably hotter and drier, then the normal development of plants is very materially affected, and results in greatly reduced arboricultural returns. It will further be manifest, however, that those causes, whether of damp soil, cold winds or excessive heat, which are inimical to normal or healthy plant growth, may become the conditions favoring the operation of other influences inimical to plant life, such as vegetable parasites, the poisonous effects of the complex organic products of an aerobic bacterial life in imperfectly aerated soils, of insects, etc., etc. I cannot forbear illustrating this point by referring to a

recent paper by Prof. H. Marshall Ward, in the proceedings of the Royal Society, "On Some Relations between Host and Parasite in certain Epidemic Diseases of Plants."

He points out what would seem self-evident, "that a plant may vary within very wide limits of the condition we term health." We may, for instance, having a herbaceous plant growing under a high July temperature with an abundance of solar light, when suddenly the temperature falls, rain sets in and the weather remains cloudy for days. Transpiration through the leaves being almost stopped the plant becomes suffused with water and the movements of the absorbed gases are greatly retarded. Now to realize the effects, we have to recognize that the growth of the plant depends upon a healthy condition of its sap, which contains corpuscles and nutritive fluids, which constitute its circulatory system just as much, and in the same sense, as the blood does in an animal. Prof. Ward further points out that the life and growth of the plant depend upon the absorption and assimilation of food, commonly spoken of as metabolism. What thus goes on in the plant depends upon the fact that the cell protoplasm absorbs oxygen brought to it from the water of the soil and from the air, and this oxygen combines with the various compounds contained in the protoplasm. These bodies are thus broken up while others form new unions. Complicated life movements are thus set up, and heat even is developed by the oxygen taking hold of the carbo-hydrates, as starch and glucose, and by the nitrogen absorbed, certain nitrogenous compounds often called, in medicine, the active principles of a plant, as asparagin, etc., are found. A most interesting fact which finds its parallel in the excessive development of acid compounds in the blood of rheumatics and persons suffering from various other troubles, is found in the excessive formation, out of protoplasm, etc., when a lack of carbo-hydrates occurs in the plants, tissues and sap, of organic acids (such as malic, oxalic, etc.) They are due to incomplete oxidation and their variations in quantity depend greatly on the activity of the metabolic processes and, therefore, on the intensity of respiration.

Remembering that the carbo-hydrates are formed by carbon dioxide and water meeting in the chlorophyll of the leaves and other growing tissues, and that the activity of the chemical changes depends largely upon certain rays of sunlight, we can in some degree comprehend how the conditions, favorable to vigorous plant life, must in a very special sense be the measure of

the resistance which any plant will make to injurious influences. Here, again, we find a parallelism to the resistance which the animal organism offers to malign influences. Housed in dark workrooms and offices with limited supplies of fresh air or oxygen, we have as a result imperfect assimilation or metabolism going on in the blood and tissues, and so we find that the germs of disease in the shape of vegetable parasites, as diphtheria, obtain an easy victory over debilitated and non-oxidized tissues.

Prof. Ward details at some length how the fungus *Botrytis* develops on many plants, and points out that sunshine is wholly unnecessary to its development, and that dull, damp weather and a saturated atmosphere, so injurious to higher vegetation if prolonged and at a low temperature, are distinctly favorable to the development of these fungi. It has been found further, that the mycelium of the fungus develops a ferment—just, for instance, as the diphtheritic microbe secretes a *leucomaine*, which acts as a poison to the human system—and that the poison possesses the property of swelling and dissolving cellulose, and further seems to kill the protoplasm at the points where the fungus has made its way into the cell-tissues of the plant. The action seems to be associated with the formation by the fungus of oxalic acid, which in excess rapidly destroys protoplasm, and so acting like other acids, causes the leaves of the plant to turn brown. The result is analogous to the effects seen, notably upon evergreens in the neighborhood of brickyards, where, during the burning, sulphurous products are given off, which being oxidized in the atmosphere, exert an acid action on the soft tissues of the growing wood.

Hence we see that whatever makes for normal growth and development in plants tends equally to enable them to resist the attacks of malign influences. We find further admirable examples of this in the wheat-rust, the potato blight, black-knot, etc., and in the conditions opposing or favoring their development.

We now naturally must turn and inquire whether we have any analogous conditions which affect climate unfavorably as regards the health of man, and if so, whether the same laws with regard to increased liability to disease become operative. Let us examine these physical influences and effects, which all will agree are largely the result of deforesting. We are accustomed to the use of the terms, (a) *equable*, *limited*, and *insular*, as applied to climates with slight yearly and diurnal variations; and (b) to *extreme*, *excessive*, and *continental*, *i. e.*, as applied to climates with great vari-

ations. As producing these we speak of proximity to extensive water surfaces, height above sea-level, etc. In addition to these classes and others, such as latitude, nature of the soil, etc., we recognize that the covering of the soil plays an important function. Herbage, as remarked by the latter Dr. Parkes, is always healthy, but trees play by far the most important part of any kind of vegetation : (*a*) By keeping the ground cool through directly obstructing the sun's rays. (*b*) By presenting in their leaves an immense evaporating surface : (*c*) By this means taking up through the roots an enormous amount of water, thereby preventing a stagnation of ground water, and aiding healthy nitrification processes by the constant introduction of oxygen into the soil : (*d*) By thereby creating a moist and cool atmosphere around the tree through evaporation, while the same process prevents rapid chilling of the soil by radiation, and at the same time, by the circulation of the sap, a rapid chilling of the tender, exposed parts of the tree is obviated.

We thus have, through the beneficent agency of trees, an equability of climate, obtained in no other way, and in so far as this is a factor favorable to health, we have a distinct advantage to be gained by the preservation of trees.

On the other side, where forests are absent, the excessively rapid changes in temperature, induced by rapid radiation of the earth's heat, affect most unfavorably those exposed to this rapid chilling, and who may not have such strength and vigor of constitution, as to resist its effects. The rapid abstraction of body heat is as inimical to the health of man as of plants, and leaves persons exposed to specific causes, which, under more favorable conditions, are inoperative. Associate with these extreme daily-ranges of temperature, frequent extremes of weather, as of winds and storms, and we have exactly those physical conditions productive of internal congestions, inducing in some form or other, those diseases which hold so prominent a place in our mortality tables. Take but one disease, the causation of which has been long in dispute. Surgeon Major Oldham, of the Indian Medical Service, insists that malaria is due to cold. Logan, in a work on the climate of Chili, tells us that malaria prevails on the table lands, while the lower levels are free from it.

So much then on this part of the influence of trees in preventing a rapid and extreme chilling of the soil and of the atmosphere contiguous to it.

Speaking in the more exact language of to-day, I would say that

these gentlemen ascribe to the moisture and cold a condition whereby a cause is given an opportunity of becoming operative by their depressing influences. In other words, the monad, the cause of malaria having entered the system becomes capable under these conditions, of multiplying and overcoming the resistance of the body, just as *Botrytis*, under similar conditions, grows in plants.

Their influence in preventing these rapid and extreme changes, applies likewise in the matter of forests lessening the changeability and violence of the wind.

Dr. Charles Smart, Acting Surgeon General of the United States army, made some careful experiments on the laws regulating radiation of heat, and other relations thereto of wind and moisture. He says there are three principal factors going to make up climate in its relations to our animal heat, viz. : (1) The absolute temperature of the air : (2) Its motion : (3) The moisture contained in it. The effects of rapid radiation upon the human system, it is assumed by a large school of etiologists, are so great as to produce disorganization of the nervous mechanism that presides over the temperature of the body, and this upsetting of the heat regulating centre is likely to happen when the body has been subjected, during the day, to extreme solar heats and fatigue, and is exposed after sundown, and in the night to the tropical or sub-tropical chill, which will be severe in proportion to the rapid cooling of the ground, and the amount of vapor condensed in the lower stratum of air.

How notable are the differences in the degrees of radiation of heat from the earth is seen in the statement made by Tyndall in connection with some radiation experiments published in detail several years ago, to the effect that were it not for this invisible gaseous envelope, with its moisture surrounding the earth, it would long ago have radiated its heat to an extent totally destructive to the life of every living organism. All of us are familiar with the old example of how on the desert plains, whose soil may attain a temperature of 150° or more during the day, radiation produces, after sundown, so rapid a cooling as to produce hoarfrost as seen on the blankets of travelers who have laid down to sleep on the sands in the open air.

In the matter of clothing our bodies we find the same laws in operation, and protect ourselves by non-conducting flannel and silk under garments.

It is well to recall what long ago was affirmed, that plagues were

stopped in their progression by forests, while there is indubitable evidence going to show that belts of trees have effectually protected communities against the emanations of malarious marshes.

I now propose to speak of an influence exerted by forests, which, studied to some extent, has from the very nature of the case, been but imperfectly appreciated. I refer to their influence, first upon ground waters, and second, as related thereto, their influences upon the processes of nitrification.

Our literature teems with illustrations of how the never-ceasing and uniform flow of springs celebrated for their curative properties, and presided over by some old-time deity, has been largely decreased by the wanton destruction of the forests which protected their sources; while in Ontario we behold the yearly decreasing volume of the dozen or more splendid rivers, which taking their rise in the central plateau, flow toward some one of the four great lakes, Ontario, Erie, Huron, and Georgian Bay.

Towns and cities have sprung up on every side, and as their needs have increased they have looked for local sources of public water supplies, only to find their local streams uncertain in amount during the later summer months, while their decreased volume has resulted in a relatively increased pollution, which makes their use as a source of public water supply, in many instances, quite out of the question. All will see how serious such a matter becomes in its relations to health. But this evil is much more far-reaching in its effects. Assuming that under ordinary circumstances the amount of water which finds its way into the soil is fifty per cent. of the total annual rainfall, it will be apparent that if in all parts of the Province, the snows, by the irregularities of the winter season, pass away rapidly, as they now frequently do during a thaw, to the streams and rivers without being taken up by the then frozen ground; if further during the spring the heat of the sun causes so rapid a melting of the snow, as to make bare the fields in a few days, and fill the streams to overflowing, there results an incalculable loss to the underground sources of supply, which we are coming to look upon more and more as reservoirs, never-failing in their abundance and perfect purity. What such losses mean may perhaps be appreciated when I say that, assuming that six inches of the twenty-five or thirty inches of annual rainfall are lost by deforesting, we have a direct loss to our underground sources of supply amounting to nearly 100,000,000 gallons per square mile of surface. What this loss means to a city which has to look to

driven-wells for its supply will readily be understood, since the more extended that the necessary gathering ground becomes the more expensive does the matter become to the city, whose demands are constantly increasing. Curious as it may appear we see on every side two constantly attendant phenomena, yearly and increasing needs of pure and sufficient water for our cities, and yearly decreasing supplies as regards both purity and quantity. Remembering that it is commonly agreed that more than eighty per cent. of all our typhoid fever is produced through the medium of drinking water; that some 700 deaths and more than 10,000 cases occur in Ontario yearly, causing a loss of labor, of more than 300,000 days, and at least as much more unproductive expenditure of capital, we can understand how from the health standpoint alone deforesting has an economic importance, well-worthy of our most serious consideration. The matter of the loss to the soil produced by the sudden disappearence of the water resulting from the melting snows, and the equally useless and even destructive effects of the torrents which are poured upon the baked and arid surfaces of our flelds, by the thunder storms of summer, have another and far-reaching influence in the matter of the retention and utilization of the organic matters of the soil. The vegetable organic matters of our virgin soils, the manures which are deposited on our agricultural lands, depend alike for their beneficial effects, upon whether they are quickly utilized by being converted through the action of the bacteria of the soil into compounds assimilable by plants. Now, upon the aeration and upon the moisture of the soil will depend the rapidity and perfection of the nitrification process. All are aware of how manured or meadow lands often seem to be productive of but little results during a dry summer, and again of how a soil cold and unaerated is equally barren of results. We recognize the reasons of this as two-fold; first, a lack of drainage, whereby the water of the subsoil is prevented from being removed in such a manner as to allow of *aeration* of the soil, and second, from a lack of warmth of soil whereby the bacteria are able to multiply rapidly. A soil left dry after the floods bakes and becomes impervious to air; while its cold subsoil may be so clogged with water, that the bacterial action which goes on is productive only of those compounds which produced by microbes multiplying in the absence of oxygen, are positively injurious to plant-life. Now, when we refer to the effects of forests upon the soil we find that, while they enable the water entangled in the in-

terstices of the leaf-mould and humus, to pass silently into the earth, protected against the scorching rays of the sun, they likewise act in the most positive manner as drains to large areas of surrounding soil. Their taproots running downward often pierce retentive clays, and the organic decomposition which goes on in the root fibres creates innumerable drains by means of which subsoil waters are lowered to a notable degree. How great this drainage becomes may be measured by the amount of water which is evaporated by a tree. Parkes and others have given us figures showing an evaporation from the leaves of a tree as equal to two and a half gallons daily, or as given by another equalling two hundred and twelve inches of an annual rainfall. This evaporation may be best comprehended by imagining it to be at least equal to one foot of water from a surface equal to fifteen feet square.

This removal of ground water, viewed from the public health standpoint, is most important. By drainage or a lowering of the ground water, Dr. Buchanan, president of the Local Government Board of England, has shown that in a few years, the death-rate from consumption in drained towns was reduced nearly fifty per cent.; while everyone is familiar with the story of how, at a Trappist monastery situated on the Roman Campagna, eucalyptus trees planted about it caused a disappearance of malaria from all the inmates except those whose rooms looked upon a damp inner court. This phenomenon being observed, several eucalyptus trees were planted in the court, when through the drying of the soil by their roots, and a utilizing of the products of normal decomposition of the soil, those conditions favorable to the development of the malarial poison in the soil were removed and the disease disappeared.

Those direct influences upon the public health, resulting from floods and cyclones, are patent to all. If there ever were a year when our legislators, our scientists, the people generally have been made aware of how nature, "*red in tooth and claw*," avenges herself on those who despise her teachings, it is the year of grace 1890. I had intended to have made a table showing the disasters from these causes, as collated from the reports of the daily press, but I have forborne. It would have recalled horrors useful only so far as they teach us lessons. Modern science is striving with much success to chain every force of nature to the car of human progress, but it would seem as if the father of the gods resents the violation of nature's laws and this destruction of her sylvan fanes, while the

stealing of the fire of the gods by a modern Prometheus results as of old only in the punishment of man. *Sic itur ad astra* seems ever to have as its refrain *facilis descensus Averno*, and to balance the evil and good between these, the lumberman and agriculturist who would subdue the earth, and those as the sanitarian, the engineer and poet who would maintain inviolate nature's gifts in the trees, is equally the aim and we trust the attainable ideal of such meetings as this.

FOREST PRESERVATION AND RESTORATION.

J. C. CHAPAIS.

In Canada some boldness is needed to speak of forest preservation and restoration. To the settler who has yet his axe in hand to fell the trees growing on the piece of land he intends to sow, the tree is still an enemy, and you cannot make him believe that a day may come when he will regret having treated it too long as such. The lumber merchant too, with forest limits apparently inexhaustible, wants to make a fortune as quickly as he can, and turns a deaf ear to economists who try to make him take thought for the coming generation.

Many districts covered with forests thirty years ago, however, contain no more firewood or timber. Very often, even agriculture has not benefitted from a clearing of trees so foolishly made, because it was made on land quite unfit for cultivation when once influence of the ashes of the wood burnt during the clearing is exhausted. I know whole regions which were cleared in that way by settlers who had to desert the land soon after, because it was worth nothing. Such districts would have been inexhaustible wood-reserves for future generations, who during an almost endless period would have found on them all the wood they wanted. To-day these same districts are quite useless in every respect.

If we wish to be listened to by the farmer, who is always prejudiced against ideas quite new to him, we must for the present speak only of what is the least apt to run counter to his prejudices. Measures not hostile to his supposed interests must first be at-

tempted. We should request our governments to direct the land surveyors, when fixing the boundaries of the new townships opened every year to colonization, to point out with precision in their reports the regions unfit for agriculture, in order that they may not be granted for that purpose.

Let us further urge that the wood-reserves thus created, as well as the forest limits rented for the manufacture of timber, be protected against the systematic and complete devastation to which they are subjected by too greedy limit owners, and against fire. Forests can be protected against such devastation by adopting and enforcing rules to prevent the useless destruction of young trees and the ill-timed felling of trees not full grown. As to protection against fire, the most effectual would be to compel woodsmen to free the land from boughs, chips, shavings, branches, and other wastage, which tend greatly to increase the number of bush fires. I know that this will be called impossible, especially by woodsmen, but what woodsmen of other countries can do, is possible for ours.

As to replanting in places where the forest has been destroyed blindly, it is still more difficult to interest the farmer in it than in forest preservation and protection. His forestry education is yet too superficial to make him apt to understand that it is not only a benefit, but a necessity to replant in denuded regions. In vain we mention the fact that there are foreign countries where, by the complete clearing of mountain slopes, fearful periodical floods are caused, which necessitate banking up the towns situated on the rivers (like the Loire for instance) taking their rise on these slopes, to prevent them from being overflowed. We may even point out the same occurrence in our own country, that the St. Lawrence is now subject to much more severe floods than it was formerly, and that we see to-day the town of Montreal protected by a dike, the same as the towns of France; and that for us this is only the beginning. But all this is insufficient to convince the farmer that replanting is necessary.

Nevertheless replanting is necessary, but as the farmer objects to planting trees, the shade of which we will not enjoy, there is happily another way of restoring forests. Almost always in the regions deprived of wood it is an easy matter to bring the land to produce by itself a good growth of trees. It is what I would call the natural restoration of forests, and to quote what I wrote on this subject six years ago in my book, *The Canadian Forester's Illustrated Guide:*

"Extensive districts, long cleared of their forest growth, fre-
"quently cover themselves again with wood, if care is taken to aid
"nature in her operations. Generally speaking, plains and damp
"marshes, where a few wretched stunted trees show themselves
"here and there, are susceptible of this treatment. Drainage, by
"means of deep open ditches, of sufficient frequency to admit of
"the tree growing, if not of perfectly drying the land, is the only
"thing necessary. The moment that this has been done a multi-
"tude of little trees will spring up, which were only waiting for
"this amelioration to show themselves, and the new growth is
"usually so prolific and so rapid that we should be inclined to call
"it spontaneous, did we not know how long seeds would lie dor-
"mant in the ground, until all things necessary for their growth
"were present. The same thing occurs on certain hill-sides,
"where, protection being afforded against the teeth and hoofs of
"cattle, their hoary heads soon become crowned with a wreath of
"luxuriant verdure."

I must state that to-day this natural restoration is well understood by our farmers, and I can prove it by an example. The tourist who travels by the Inter-colonial Railway from Quebec down to Rimouski, in the Province of Quebec, goes through a region of one hundred and eighty miles, which forty years ago was for the greatest part in forest. This forest has been felled, burnt, and has made place for numerous settlements. But the land forming the slope of the mountain range, at the bottom of which runs the railroad, having been found unfit for cultivation, has been left by itself to make a second growth of wood. The new trees have been thinned, well taken care of, kept uninjured from the teeth and feet of animals, and now, from Quebec to Rimouski, you will see fine maple bushes grown on the land once wrongfully deprived of its trees by the old settlers.

WHAT CAUSES THE CYCLONES.

Mrs. S. W. Dodds, M. D., St. Louis, Missouri.

It is well-known that large bodies of heated air sometimes create atmospheric disturbances; also, that heat expands air or gases, and that in this rarified state they will rise, and give place to other volumes of gaseous matter. There are many familiar illus-

trations of this. Suppose the air in a room is much warmer than that outside, and there is a long window with its top near the ceiling, and its bottom near the floor. If we slip the sashes a little both at top and bottom, and then hold a lighted candle near the openings, we shall perceive that hot air rises and forces its way out at the top; and the cold air from outside rushes in at the bottom to take its place.

Now, if instead of a room, we have a vast area of country filled with super-heated air, what will happen? The hot air will rise as before, passing into the upper strata of the atmosphere, and the cooler air will rush rapidly in to take its place. This, indeed, is just what happens in the torrid zone, both on sea and land; and also in some parts of the temperate zones, where there are immense deserts, and in these countries tremendous tornadoes or cyclones are common.

Near the equator nature has produced an abundant vegetation; there are great tropical plants and dense forests; trees and shrubs with their thick foliage, which intercept the sun's rays and equalize or dissipate the heat. There are also luxuriant grasses covering the surface of the earth, and keeping it relatively cool. But suppose men strip the earth of this covering, cut down the trees, or dig them up root and branch. Suppose they do this over an area of thousands or hundreds of thousands of square miles—what then? The sun forthwith withers the tender grass, the fragile undergrowth of shrubs, and the clinging vines. The once green earth is laid bare, both on hillside and plain, and when the rains come, the waters will pour down the hills and mountains in torrents, and rush on to the rivers, and by those great arteries to the sea. The gentle showers that came at frequent intervals are now of rare occurrence, and the country suffers from long droughts. Instead of light mists or showers, there are heavy, beating rain-storms, and often great water-spouts; these accompanied with wind and carrying everything before them. Trees are torn up by the roots, and immense rocks lifted from their foundations.

But the men, meanwhile, are still at work; they continue to fell the trees, until the very mountain sides are bare. The plains are converted into vast prairie lands. The sun scorches these plains, killing everything that has life. And by and by there are no more rains; the immense bodies of heated air are of such magnitude, covering such vast areas of country, that a reduction of temperature necessary to condense the moisture and cause rain-falls, can-

not be produced ; the right conditions are no longer present. In other words, the once fertile land has been converted into a desert.

This is what has actually come to pass in certain countries. A popular writer of our own times has shown conclusively that many —if not most of the great deserts in the world—have been made by man, and in the way already stated. This writer shows that the work is still going on, and that unless we can stop it, vast saharas or barren wastes will take the place of the once fertile fields. He thinks, too, that our so-called great American desert was produced in this way, and that there are forces now at work, which, if unchecked, will convert large portions of our country into desert tracts.

Take the State of Ohio for illustration. Thirty or forty years ago it had a magnificent timber land, beautiful forests, even in the more thickly inhabited portions. Some of these forests, it is true, had been cleared away to make room for farms ; but there was still plenty of timber left, to say nothing of the orchards, ornamental trees and other shrubbery about the dwellings. Great changes have taken place in Ohio ; her beautiful forests are nearly all gone, at least in the middle and southern portions of the State. Instead of thick groves here and there, the little fringes of timber are so thin and vapory, that they are as nothing, comparatively speaking. As one passes through on the railway, even these meagre strips of timber recede farther and farther from sight, and we realize the fact that the once beautifully wooded State of Ohio has been, in a great measure, transformed into one vast prairie.

What is true of Ohio, is to a large extent, true of many of the other States. The forests have been cut off too closely, and the climate of the whole country has been changed. The April showers are now the exception, and either beating rain-storms or long-continued droughts are the rule. And when the down-pour comes in the spring time, there are neither trees nor undergrowth to absorb the water, it rolls down the bare hill-sides and slopes into the rivers, and great damage to fields and farm lands, towns and cities, must necessarily follow, from extensive inundations.

Have we no connection here between cause and effect? The reasoning, it seems to me, is plain, and the sooner we make a note of the facts in the case the better it will be for us and for those that must follow after us. Unless some preventive measures are taken, the storms will continue and increase in severity. The great bodies of heated air that arise from the surface of twenty different

States, are disturbing the electric and other conditions of the atmosphere, and essentially changing our climate. Even the states that are not yet so closely stripped of their timber suffer more or less from the general conditions. The snows of winter are becoming practically things of the past, and the genial showers are few and far between. The scorching droughts are prevalent, and the shortness or failure of crops is in proportion.

I used to wonder what made the great prairies in Illinois and Iowa. It never occurred to me that a former race of people had probably done for these States just what we are doing to-day in Ohio, Indiana, Pennsylvania, New York, Kentucky, the Carolinas, and many other States. And as I listened to the birds in my childhood, I little thought that in a few decades the birds and forest trees would alike disappear, while swarms of insects (which the birds would have eaten) almost take possession of our land, eating up the crops. Have we not ourselves to blame? We have, to a great extent, stripped the country of its trees, and without trees we shall find few birds, while the insects will be left, and if these pests are plentiful the crops will be destroyed. Ohio, once a fine fruit country, can scarcely produce apples, the curculio takes them, and also the plums. Even the small fruits are cut off by the frequent droughts. The same is true of many other states.

Four years ago I was on the Pacific coast. The destruction of timber is going on there. The hills around the beautiful lake Tahoe being already nearly bare. This, indeed, is a burning shame! In all that country the pines are fast disappearing. The lumbermen are shipping them to distant points, and the green hills will soon be almost as destitute of tree-life as the plains of Colorado. The birds are going with the rest; in fact, every loafer or boy that can carry a gun is after them. There will most assuredly be a sequel to all this; even now, in that distant coast country, so noted for its fine climate, the storms are finding their way. Why not? Like causes must produce like effects.

What, then, is the remedy? Shall we wait to find it till the storms become hurricanes, and the high winds tornadoes, each as frequent as in the torrid zones? We hear a good deal about irrigation. Given water, it is said, and the desert can be made to bloom. Very true; but we had better have kept the water when we had it and with it the trees, the foliage, the birds, the crops. Whether we can bring them back is a serious question. We may find it a long way to travel back to the right road, but we might,

at least, search it out. The trouble, I fear, is that we are not looking for it. But the time is near at hand when we shall be forced to seek it; to do what England has done; Germany, France, and other European countries. We must replace our trees, enough of them to modify our climate to a certain extent. If we once begin we may save a great part of this country from becoming, sooner or later, hopelessly barren, and mitigate the fearful and destructive storms, which are already a terror to the people; but we must begin in time.

THE PRESERVATION OF SMALL FORESTS.

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The greatest obstacle in the way of securing efficient action for the preservation of the public timber lands arises from the lack of personal interest in the work. The public forests are spread over a wide territory; their character and condition are only partially known to the mass of those living near them, while the bulk of the people, resident at a great distance, know hardly anything about them and feel little interest in them. They do not see what benefit their preservation will be, or what loss, if any, they are likely to suffer from their destruction.

In the case of private forests there is, of course, no lack of personal interest. But the difficulty here is that the interest is so limited in duration that there is no adequate motive for proper forest management, while the limited extent of individual holdings usually prevents any such continuity of woodlands as will secure the best forest results. Our system of land tenure and the habits of the people are such that any parcel of land may pass into the possession of a new owner at any time. The prospect of pecuniary gain or saving, however temporary, is enough usually to occasion the transfer of land from one to another, and most landowners in this country hold their lands in the consciousness of such uncertain and limited tenure. Of course the motive for planting or properly caring for woodland is correspondingly weak. Then also the length of time requisite to bring trees to their

maturity discourages effort or outlay in planting or managing forests. What advantage can a man, with his limited and uncertain tenure of life, hope to gain from planting forest trees or cultivating most effectively his partly grown woodland, when a century or two is needed to bring his trees to their harvest time? He stands dismayed before the slow-rounding cycles of the oak or the pine. With a system of entails it would be different, for one would feel that though his own life might soon come to an end, his efforts and expenditure on his estate would not be wasted, but would accrue to the benefit of his children and children's children.

What our country needs, therefore, for the most successful dealing with forests, is a personality whose life is as lasting as that of the trees themselves. The Nation is such a personality, and hence the Nation or State can care for the forests in the best manner and use them to the greatest advantage and with the highest profit in all respects, as is seen by the forest management of European countries. The same is true of counties, towns, parishes and precincts, as well as private corporations. They can properly undertake any enterprise, no matter how much time it may require for its accomplishment. To such an unlimited life, to grow a forest, even of sequoias, is no more than for an ordinary person to grow a crop of corn.

Why may we not avail ourselves of this larger, longer life for the establishment of forests, if not on as large a scale as we would like, yet so as to secure very desirable advantages? Why may we not have something like the communal forests so frequent in Europe? While encouraging every farmer and land-owner to preserve a due portion of his existing woodland and to plant shelter-belts at least, why may not our counties and towns as such establish and maintain forests? In many of our counties and in many of our towns there are tracts of land, sometimes of large extent, often comparatively small, but many in number, which are unfit for ordinary cultivation, because they are stony, or swampy and not easily drained, or lie on steep hillsides. As they are now, they do not yield more than enough to pay the taxes assessed upon them. But while thus unprofitable in their present condition they could all be profitably used for the growth of forests. There is no land where trees will not grow, and there is no crop which can be grown so cheaply as a forest. Why should not the county or town utilize such tracts, by taking them out of their present unprofitable condition and devoting them to a remunerative

forest growth? Such tracts would often be given to the town or the county: in any case they could be bought at a very low price. Where there are several small patches of woodland, or lands partly wooded, but separated from one another, there would be a marked advantage over the existing condition of things. These small patches, if wooded at all, are of value now only for their small yield of fuel and inferior timber. If they were in the possession of the county or town they could be combined, the necessary connecting land also being taken, so as to form such a continuous stretch of woodland as to possess more or less of the qualities of a forest, exerting climatic and other influences. Such an extent of woodland would also warrant better management and be more productive than smaller parcels. From time to time also the town or county could extend this forest area by gift or by purchase, as the private person adds to his land, and as is done, in the case of their larger forests, by the European States.

Another advantage gained by the town or county forest system would be their protection of such forests from fire and other injury as no strictly private forest or forests belonging to the general government would be; for the whole community would have an interest in watching them as their own property, and if fire should by any chance break out, every one would be prompt to help in extinguishing it.

Such forests could be cared for and maintained at a minimum of expense and a maximum of profit. This would be as the result of the general law, that a large business is more economically managed than a small one. The proprietor in this case, the town or county, or trustees or other corporate person, would always be able to command the requisite labor at the proper time. The work would be done under no such stress for immediate results as often urges the private land-owner; therefore the work would be done the more cheaply. If an existing woodland or several tracts were thus taken in hand, the clearing of the rubbish and necessary thinning could often be secured with little or no outlay of money.

There can be little doubt that a fair rate of interest on such an investment as this could be secured. Examples of the management of such limited and local forests abroad indicate this very plainly. The forest owned by the city of Zurich, Switzerland, consists of about 2,500 acres, lying on both sides of a stream in a rather narrow valley between high hills, and is nearly five miles in length. It is about an hour's ride from the city. It has long

been managed as a source of revenue with satisfactory results. Last year the net profit was more than $10.00 per acre. But other considerations besides the mere pecuniary advantage would be taken into account by town or county proprietors. The sanitary influence of such forest reserves would deserve regard. Their influence upon adjacent agricultural lands would also properly be taken into account, and their general climatic effect whenever they were of considerable extent.

Such forests would also incidentally become valuable as experiment stations, where many kinds of trees would be tested on whatever varieties of soil and exposure the grounds might furnish, and thus every landholder around might learn much as to what trees it would be most desirable for him to plant on his own premises.

A nursery would also naturally be a part of the equipment of such a forest, for the purpose of rearing trees to fill the places of those cut from time to time. And this might easily be made a source of revenue, by the sale of young trees to the land-owners of the town or adjacent region.

Finally, such a forest might have a value over and above any of a pecuniary kind, by being made a place of pleasant resort for the whole community, a place of special meetings on various occasions and of healthful recreation at any time. Thus the people would cultivate their forest, and it in turn would cultivate them, developing in them a taste for natural objects, opening their eyes to new beauties and new sources of delight, binding them together in society, and endearing to them their dwelling place more and more with the passing years.

TREE CULTURE AND EXPERIMENTS WITH SOUTHERN TREES IN THE FAR NORTH OF QUEBEC.

AUGUSTE DUPUIS, LES AULNAIES, QUE.

Convinced by what I heard at the meeting of this Association at Montreal, in 1882, that it was the duty of every owner of woodlands to follow the rational suggestions for their management there made, I laid the matter before the L'Islet County Horticultural Society, which decided that the best means to ascertain how the

farmers generally managed their woodlands, was to offer prizes to those who had preserved their woodlands best, or who had the largest area in good timber of new or second growth formed by natural seeding and properly thinned.

Prizes were offered by the Society and private members, and judges named to examine the woodlands of several competitors. The first prize was for sixty-two acres of sugar maple trees, all large enough to be tapped for sugar, all second growth, which had been repeatedly thinned. The first thinning was of no value; the second, third, and fourth thinnings were valuable as firewood and paid for the work. The original growth had been cut down entirely except a few maples left on some stony hills, which served to reseed the land, some of which had been plowed thirty-five years before the visit of the judges.

Three other prizes were given for maple groves of fifty, fifteen, and three and a half acres respectively, similarly managed. It was ascertained that many farmers were following this mode of re-wooding their lands, but the majority neglected the seedlings, which, being too thick, made sickly, slender trees of no value. The prizes attracted the farmers' attention to the subject, and the following years a good many acres were thinned in the fall. I myself thinned thirteen acres in two years, and the trees left have since made an enormous growth.

I have here plants and branches of trees hitherto unknown in the eastern part of the Province of Quebec, grown from seeds procured in the fall of 1884. I made this experiment without expecting any profit therefrom, but only to ascertain the degree of hardiness of each.

In 1887 at the Provincial Exhibition at Quebec, I had fifty-two distinct varieties of trees (seedlings) of the above plantation, for which a diploma was awarded.

Most of the seedlings had grown well and I expected to declare hardy, trees that had hitherto been considered tender in my district and to the south-west. But I was disappointed, the third and fourth year, to find that several kinds throve and resisted the winter when they grew below the snow level, but the new growth over the snow was entirely frozen in some and partially in others. I will name some of the trees, and you may see by each tree and branch on this table the damage caused by frost. The trees were planted in exposed situations and without protection.

Ailanthus. Not hardy, freezes from the root.

Ash leaved Maple. Very hardy.

Birch, Cut-leaved European. As hardy as the American. This very ornamental trees thrives splendidly and is reproduced easily from cuttings.

Butternut. This beautiful tree is hardy and seems to grow as quickly here as in Massachusetts.

Black Walnut. It has not proved hardy on my sandy soil. The seedlings were destroyed by the freezing of the roots. Ice had formed over the plantation three inches thick and thawed only in spring. The plants had not a fair trial.

Catalpa. Not hardy here. I lost the trees after the third year.

Chestnut. Doing well and is very ornamental.

Common Locust (P. Acacia). This tree, on sandy dry soil, seems hardy, its growth being slow, but at the Manor des Aulnaies, trees twenty years old, which annually bore an abundance of fragrant flowers, were all winter-killed in 1887.

Golden Willow. This tree grows rapidly for ten or twenty years, and though looking healthy is suddenly winter-killed. This is what happened to many large trees last winter.

Honey Locust. Not hardy. I lost trees (winter-killed) that seemed well protected by a belt of balsams.

Kentucky Coffee. Trees seemed hardy until the third year, but part of each year's growth has annually frozen since.

Kilmarnock and New American Willows. Hardy, doing well.

Linden, European. Hardy like the native, the leaves are smaller.

Elm, European. No improvement on the native. Hardy.

Elm, Cork-barked. Did not thrive on my dry soil.

Maple, Silver-leaved. Hardy rapid grower. Since two years an insect has attacked the leaves, spoiling the appearance of the tree.

Maple, Red Colchicum. This rare and beautiful Japanese variety is not hardy: all the growth above the snow level freezes.

Maple, Sugar. This native variety transplants with so little success, that I was induced to sow seeds in 1882. I am convinced that a nicer and healthier maple grove can be established by sowing than by transplantation of trees from the forest. These maples, planted in 1882, are now from fifteen to sixteen feet high.

Norway Spruce. I was very unsuccessful with a plantation of two hundred and fifty Norway spruce planted in autumn, 1886.

Magnolia Soulangeana. The seedlings were from St. Catharines, Ont., and were all winter-killed first year.

Horse Chestnut. This tree was considered very hardy. We see trees seventy-five to eighty years old at S. Jean Port Joli, but last winter many trees fifteen to twenty years old, imported from Rochester, died. Trees from seed of the old trees at S. Jean are very hardy and vigorous.

Oak, White. Very scarce in the forests of this section. The young plants I raised grow very slowly. Several of them transplanted amongst other trees thrive much better.

Oak, Burr, Black, Swamp, Red, Pin, Laurel, Spanish, and Turkey. The branches are from acorns sown in 1884. They have not made much growth since. The soil is not rich, and I do not think it advisable, for the trial of trees to ascertain their hardiness, to enrich the soil too much, which might force a late autumn growth not ripe enough to endure the winter. I see no great advantage in introducing these oaks, as many of them suffered by frost.

Tulip tree. Three years trial is probably not sufficient to pronounce it hardy East of Quebec. Still, I have great hopes in the success of my small plantation, as only the terminal buds were bitten by frost.

SHADE AND ORNAMENTAL TREES FOR CITIES.

GEORGE MOORE, MONTREAL.

The importance of judicious tree planting to the beauty and health of cities needs no argument, and I may therefore proceed to notice, briefly, a few details.

First.—The varieties of trees most suitable for street planting, are the elm, (*Ulmus Americana*), and the maple (*Acer platanoides or Norway maple*). Their stately, but compact habit of growth, their wealth of luxuriant foliage, their non-liability, generally speaking, to the ravages of insects, and their freedom from danger caused by the extremes of temperature, are qualities which render them the trees *par excellence* for our purpose. A mixture of both species in the same avenue is not advisable, because uniformity of growth should be aimed at; hence it would be better to plant elms in the main thoroughfares, and maples in the shorter, or narrower ones. Also for the sake of the uniformity so desirable, the planting of trees in the public streets should be

undertaken by the municipal authorities, for, if left to the individual property holders, the result will be unsatisfactory, because one would perhaps plant a willow, and another an ash, or a poplar; and at unequal distances. In this city, for example, this state of things is much to be deplored. If the Grande Allée could be made of the same width from the Parliament House to the Governor's residence, and planted with elms at equal distances, say sixty feet apart, of the proper quality, what a magnificent drive it would become a few generations hence!

The quality of the young trees to be planted claims our particular attention. These should be nursery-grown seedlings, properly prepared by frequent transplanting and pruning to adapt them to the purpose. It may be objected that nursery-grown trees cannot be obtained, but were they used in preference to those from the forest, the demand would create the supply, and enterprising nurserymen would raise them in large quantities.

In a recent article in the *Quebec Journal of Agriculture*, our Vice-President, Mr. Joly, advises every land-owner to establish a small nursery on his own account in which to raise and cultivate seedlings of such shade and ornamental trees as he might require for his own use. When we consider that every estate is so much improved by good trees, and the advantages of rapid and symmetrical growth which such trees possess over those taken from the forest, we must hail with interest the valuable suggestion.

Great mistakes are made by corporate bodies or their employees, entrusted with public money for the purpose of tree planting, by trying to do the work as cheaply as possible. Economy does not consist in the purchase of unsuitable articles, nor in the employment of inefficient workmen. It is remarkable that these very persons are most particular as to material and execution of all other public works, but when it comes to the delicate and intricate operation of tree planting, in which mistakes are fatal to success, they think it so simple a matter that any tyro can perform it, and therefore set one to work to grub trees out of the forest and plant them without regard to the proper method; the inevitable result being failure, loss of money, and what is almost more serious, loss of time.

Trees dug from the forest must have their large roots severed for the purpose of removal, and are therefore very liable to fail under the ordeal, besides which they are one-sided and ill-shaped from having grown in too close proximity to other trees. They are therefore a long time, supposing they survive, in becoming

ornamental ; being, if small, like whip-stocks, or, if large, having been stripped of their branches to bring them into shape, like miniature telegraph poles, and surely our cities are already sufficiently disfigured with these. On the other hand, properly cultivated trees are well furnished with fibrous roots, which render their successful transplanting by skilful hands almost a certainty ; and their branches are so arranged by judicious pruning as to make them beautiful objects as soon as they begin to develop their foliage, the very first season. The first cost of such trees is considerable in proportion to the others, as the nurseryman must be paid for the necessary labor, knowledge, and time to produce them, but eventually the outlay will not be greater, and even a saving may be effected, for it is more than probable that the forest trees will have to be replaced several times before any will succeed.

Cheap labor in this respect is usually the dearest. Properly qualified and careful men alone should be employed, and those under the superintendence of a competent and responsible foreman, who will see that the holes are dug with a due regard to the spreading of the roots, and of a sufficient size and depth ; which in street tree planting should be larger than under ordinary circumstances ; not less than four feet square and three feet deep. The gravel, or poor soil of which streets are generally composed, having been removed, the hole should be filled with partially decayed sods and a little well-rotted manure to give the plant a good start and insure vigorous and rapid growth.

A writer in the Montreal *Witness* lately suggested that gratings should be placed round trees in cities, so as not to impede the sidewalk ; to admit air and water to the roots, and which could occasionally be removed and the earth loosened ; this is unquestionably a good suggestion, for as the writer remarks, concrete and paving stones prevent the roots from being duly aerated and moistened ; processes necessary to the rapid and healthy growth of a tree. There has been much controversy as to the proper season of planting, but practical arboriculturists are now pretty well agreed that spring is the best, especially in this northern climate.

Though trees of moderate size are transplanted with the greatest safety, the necessities of the case demand that those for street planting should be larger than for ordinary purposes, being more exposed to danger of injury from various causes. They should be at least one inch and a half in diameter of the stem, which should be not less than eight feet high up to the first branches. They must be stout and stocky, which they will be if they have

received careful attention, and been twice or thrice transplanted before leaving the nursery.

The distance at which trees are planted from each other must be regulated by circumstances. Elms in broad avenues should not be less than sixty feet apart, but maples may be a little closer. The shade should not be too dense, and a free circulation of air should be allowed around each tree when grown. Then each will be a specimen of symmetry and beauty in itself, and form a more elegant component part of the whole avenue.

It is most important that pruning should be done annually for the first few years at least, if the tree is to assume the desired perfection of shape, or become what the English call a "pictorial tree." This should be done by competent persons only, whose practical knowledge and judgment will guide them as to which branches to remove, and which to retain, to accomplish the end in view. If trees are allowed to go for years unattended to as to pruning, they can never be made so handsome, and are besides very much injured by the cutting away of too large branches.

Science points to the fact that when the sap is in the best condition to effect the healing of the wound quickly, is the proper time to prune, and this is in the early summer as soon as the young leaves expand.

Boxes, to protect from injury, and to keep them in their places, should be put around every tree ; these should be of a plain, but artistic design, and painted dark brown, as best assimilating with the color of the trunk, and harmonizing with that of the foliage.

In every city, by-laws should be enacted for the care and protection of their shade trees, and no vandal should be allowed to cut and hack them in the manner too frequently done. A properly qualified and duly appointed officer, with full authority to arrest depredators, should have all the shade and ornamental trees under his charge, and if absolute necessity arises for the cutting away of any roots or branches, he should be duly notified, and the trees should be touched only under his direction and supervision.

In view of the sanitary advantage to the dwellers in cities, and especially to the working classes, to say nothing of the improved appearance of a place by the formation of parks, and the planting of lines of trees in the leading thoroughfares, it is an urgent necessity that steps be taken to foster and encourage the planting and after-care of trees everywhere, and to impart to the public as much of the knowledge necessary to success as will make the practice popular and conducive to their comfort in so many respects.